SELECTED

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VOLUME 4, NUMBER 15 AUGUST 1, 1971 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED WATER RESOURCES ABSTRACTS

'A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



VOLUME 4, NUMBER 15 AUGUST 1, 1971

W71-07702 -- W71-08321

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency, Water Quality Office. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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DIRECT DETERMINATION OF THE ELEC-TROMAGNETIC REFLECTION PROPERTIES
OF SMOOTH BRACKISH WATER TO THE
CONTINUOUS SPECTRUM FROM 10 TO THE
8TH POWER TO 4 x 10 TO THE 9TH POWER HERTZ,

Univ., Honolulu Water Resources Hawaii Research Center.

For primary bibliographic entry see Field 07B. W71-07974

02. WATER CYCLE

2A. General

GLOBAL WATER BALANCE ACCORDING TO THE PENMAN APPROACH, Hawaii Univ., Honolulu; and Pennsylvania State Coll., State College. For primary bibliographic entry see Field 02D. W71-07809

PROBLEMS OF GLOBAL HYDROLOGY (RUSSIAN: PROBLEMY GLOBAL'NOY GIDROLOGII),

G. P. Kalinin. Leningrad, Gidrometeorologicheskoye Izdatel'stvo, 1968. 377 p, 83 fig, 58 tab, 260 ref.

Descriptors: *Hydrologic cycle, *Runoff, *Surface-groundwater relationships, *Water resources development, Oceans, Lakes, River basins, Reservoirs, Water balance, Aquifers, Water consumption, Confined water, Water supply, Water purification, Computers, Forecasting, United States. Identifiers: *USSR, Closed basins, Atmospheric circulation, International collaboration, Caspian Sea

The purpose of this monograph is to analyze the earth's water balance and to examine its role informing the earth's surface and conditions for human life. Global hydrology, as a branch of general hydrology, embraces such problems as (1) study of the water cycle and influence of human activity on it; (2) spatial-temporal analysis of hydrologic processes for vast areas and for the earth as a whole; (3) development of deterministic and statistical patterns in the fluctuations of hydrologic processes; (4) identification of zones of synchronous and asynchronous variations in runoff; (5) paleographic reconstructions of the earth's water regime; (6) long-range forecasts of the state of earth's water resources and their effects on development of processes taking place on earth; and (7) study of the interrelationship of natural waters and formulation of scientific principles for controlling the water regime of vast areas. The closing section stresses the need for promoting international cooperation among scientists in the field of hydrology. (Josefson-USGS)

W71-07949

STUDY OF WATERSHED CHARACTERISTICS AFFECTING THE HYDROLOGIC PER-

AFFECTING THE HYDROLOGIC PER-FORMANCE, India Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering; and Soil Conservation Research, Training and Demonstration Center, Ootacmund

For primary bibliographic entry see Field 02E.

W71-08072

COMPARISON OF DIMENSIONLESS UNIT HYDROGRAPHS IN THAILAND AND TAIWAN, Colorado State Univ., Fort Collins; and Asian Inst. of Tech., Bangkok (Thailand); and National Energy Authority, Bangkok (Thailand).
For primary bibliographic entry see Field 02E.
W71-08084

FLOOD PRODUCING RAINSTORMS IN ASSAM AND ASSOCIATED METEOROLOGICAL CON-

Meteorological Office, New Delhi (India) For primary bibliographic entry see Field 02B. W71-08095

THE BRAHMAPUTRA DRAINAGE SYSTEM AND FLOODS IN THE ASSAM VALLEY, Assam Directorate of Geology and Mining (India). For primary bibliographic entry see Field 02E.

THE WATER BALANCE AND ITS TRANSFORMATION IN THE USSR (RUSSIAN: VODNYY BALANS SSSR I YEGO PREOBRAZOVANIYE). For primary bibliographic entry see Field 04A. W71-08104

EFFECTS OF CHANNEL CHARACTERISTICS ON TIME PARAMETERS FOR SI WATERSHED RUNOFF HYDROGRAPHS,

Minnesota Univ., Minneapolis. Water Resources Research Center.
P. Golany, and C. L. Larson.

Available from the National Technical Information Service as PB-199 373, \$3.00 in paper copy, \$0.95 in microfiche. Minnesota, Water Resources Research Center, Bulletin 31, 1971. 130 p, 48 fig, 38 tab, 47 ref. OWRR Project No: B-007-MINN

Descriptors: *Rainfall-runoff relationships, *Mathematical model, *Peak discharges, Watershed, Hydrographs, Storm runoff, Routing,

Computer, Overland flow, Channels.
Identifiers: *Time parameters, *Time to equilibrium, *Watershed model, Time of concentration, Time to peak, Lag time.

Most, if not all, parametric methods for predicting peak runoff from small watersheds require some type of time parameter as part of the runoff routing. The effects of watershed characteristics such as length, slope and roughness of the main channel and watershed area on time parameters were investigated in this study. A mathematical model and a computer program were developed for solving the dynamic equations of continuity and momentum to route nonsteady runoff through a channel system. A theoretical equation for computing the time to virtual equilibrium (time required for the rate of runoff at the outlet to become equal to the supply rate) was derived. The results of the research indicate the relative effect of the overland flow on the time to virtual equilibrium of the watershed decreases as the watershed size increases, and vice versa. The time to virtual equilibrium decreases as the supply rate increases and the non-linearity of the runoff process is shown. (Walton-Minnesota) W71-08121

2B. Precipitation

THE WORLD DISTRIBUTION OF ANNUAL PRECIPITATION EFFICIENCY, Victoria Univ. (British Columbia).

Stanton E. Tuller. Journal of Geography, Vol 70, No 4, p 219-223, Apr 1971. 2 fig, 1 tab, 7 ref. Descriptors: *Climatic data, *Precipitable water, *Water vapor, *Precipitation (Atmospheric), *Climatic zones, Deserts, Meteorology, Weather data, Temperature, Tropical regions, Evaporation, Condensation, Synoptic analysis.

Identifiers: *Precipitation efficiency, *Dynamic

precipitation mechanisms.

The atmospheric water vapor, acted upon by dynamic precipitation mechanisms, is the source of precipitation. The greater the precipitable atmospheric water vapor, the greater the latent heat supply available for the maintenance of precipitation. The amount increases with temperature and proximity to evaporative moisture sources and decreases with altitude. The maximum amounts are found over tropical oceans and decrease toward land, toward higher mountains and toward the poles. A world map of mean precipitable water poles. A world map of mean precipitable water vapor shows that it is poorly correlated with recorded precipitation. Some of the worlds major deserts have annual mean precipitable water vapor greater than Europe or most of the U.S. It therefore follows that the key to precipitation lies more with the active precipitation mechanisms which will cause the necessary lifting, cooling, condensation and drought formation. Precipitation efficiency is cause the necessary lifting, cooling, condensation and droplet formation. Precipitation efficiency is the ratio of average daily precipitation divided by the mean precipitable water vapor, which gives an indication of relative atmospheric stability with time. It has been a neglected concept, until recently, because there was little available data on precipitable water vapor. A world map of precipitation efficiency is presented and discussed. High indexes are associated with regions of atmospheric instability and low indexes with atmospheric stability. (Casey-Arizona) ty. (Casey-Arizona) W71-07810

A SELECTED ANNOTATED BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES OF IRAQ, JORDAN, LEBANON, AND SYRIA (1960 -

Environmental Technical Applications Center (Air Force), Washington, D.C.

Vincent J. Creasi, Dennis L. Boyer, and Alvin L.

Technical Note 70-5, May 1970. 27 p, 112 ref.

Descriptors: *Bibliographies, *Climatology, Environment, Meteorology, Climatic data, *Precipitation (Atmospheric).
Identifiers: *Middle East, Iraq, Jordan, Lebanon,

This bibliography contains 112 references to Environmental Studies concerning four Middle East Countries, Iraq, Jordan, Lebanon, and Syria. Approximately, 50 items are general references that pertain to one or more of the subject countries. Sixteen additional bibliographies of a meteorological and climatological nature are listed. Entries are listed alphabetically by author. A subject index is included for convenience of use.

THE STRUCTURE OF THUNDERSTORM RAINFALL, Illinois State Water Survey, Urbana.

John B. Stall, and Floyd A. Huff. Meeting Preprint 1330, American Society Civil Engineers National Water Resources Engineering Meeting, Jan 11-15, 1971, Phoenix, Ariz. 29 p, 12 fig, 7 tab, 17 ref.

Descriptors: *Thunderstorms, *Rainfall, *Storm structure, *Illinois, Radar, Cloudbursts, Flash floods, Runoff, Cloud physics, Rain gages, Peak discharge. Identifiers: *Urban hydrology, *Chicago.

In the Midwest, heavy storm rainfall occurs most frequently from thunderstorm cells. The rain cell reaching the ground has a diameter of 3 to 6 miles, and area of 15 to 30 square miles, moves at a velocity of 20 to 30 miles per hour, and has a duration of 30 to 60 minutes. Most of the rainfall occurs

Field 02—WATER CYCLE

Group 2B-Precipitation

during the first 10 minutes; it occurs in 2 to 4 bursts, and 2 or 3 cells usually occur together. The resulting dynamic rainfall input onto an urban basin is a matrix in six dimensions of : depth, area, duration, frequency, sequence, and place. In con-sideration of the possible mean, inherent variabili-ty, and skew of each of these six parameters the resulting matrix is almost impossible to evaluate. Illustration are given of five traditional, two-dimensional plots dealing with various pairs of these six parameters or dimensions. Using point rainfall data for north-central Illinois, the Road Research Hydrograph Method is used for an urban basin in Chicago to show the effect of rainfall variability on the resulting flood runoff hydrograph. (Woodard-W71-07924

MICROCLIMATOLOGICAL STUDIES OVER THE SEWARD GLACIER SNOWPACK, Michigan Univ., Ann Arbor. Dept. of Geography. For primary bibliographic entry see Field 02C. W71-07960

CLOUD-SEEDING EXPERIMENT, TASMANIA, 22 DECEMBER 1966 TO 26 FEBRUARY 1969, Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of

Radiophysics. For primary bibliographic entry see Field 03B.

FREQUENCY ANALYSIS OF RAINFALL IN-

TENSITIES FOR BOMBAY (COLABA),
Maharshtra Krishi Vidyapeeth (India). Dept. of
Agricultural Engineering; and College of Agriculture,
Poona (India). Dept. of Agricultural En-

gineering. A. I. Patel, and S. S. Vanjari. Journal of Soil and Water Conservation in India,

Vol 18, Nos 1 and 2, p 13-21, 1969. 9 p, 2 fig, 2 tab,

Descriptors: *Rainfall intensity, *Depth-area-duration analysis, *Frequency analysis, Data collec-tions, Runoff forecasting, Rational formula, Rain gages, Statistical methods. Identifiers: *India, Bombay (India).

Rainfall records of Bombay (Colaba Observatory) were analyzed to develop rainfall intensity-duration-frequency curves. For this purpose frequency analysis of rainfall data over a period of 35 years from 1933 to 1967 was carried out using the Gumbel technique. Annual maximum rainfall intensities for each of the ten durations were calculated by analysis of self recording raingage charts. The extended duration principle was applied wherever data for longer durations were not available. Fisher-Tippett type I extreme value distribution was assumed to provide an acceptable fit to the data. Rainfall intensity-frequency curves for 5 minute, 10 minute, 15 minute, 30 minute, 1 hour, 2 hour, 4 hour, 8 hour, 16 hour, and 24 hour durations were developed. The length of record can be considered to be adequate when determined by applying Student's 't' at the 10% level of significance. (Knapp-USGS) W71-08070

A STUDY OF THE RAINFALL OF THE LOWER GANGETIC BASIN FOR VARIOUS DURA-TIONS AND RETURN PERIODS, Meteorological Office, New Delhi (India).

P. S. Harihara Ayyar, and B. L. Sharma. Indian Geohydrology, Vol 5, No 1, p 11-25, Dec 1969. 15 p, 4 fig, 18 ref.

Descriptors: *Duration curves, *Depth-area-duration analysis, *Runoff forecasting, Distribution patterns, Hydrologic data, Mapping, Rainfall disposi-tion, Irrigation water, Monsoons, Regions, Synop-

Identifiers: *India, *Gangetic Basin (India).

A study of rainfall for one hour and 24-hour duration has been attempted for the lower Gangetic Basin of India, using Gumbel's Extreme values method. The magnitudes of rainfall likely to be reached or exceeded in one hour and 24 hours for various return periods are presented in the form of maps. About 80% of the area in the basin is arable. The annual rainfall of the area ranges between 110 and 170 centimeters. The rainfall generally decreases from the south-east to the north-west. The four monsoon months, June to September, constitute the main rainy season for the basin. However, appreciable rainfall occurs in the months of May and October. (Knapp-USGS) W71-08094

FLOOD PRODUCING RAINSTORMS IN ASSAM AND ASSOCIATED METEOROLOGICAL CON-DITIONS,

Meteorological Office, New Delhi (India). P. S. Pant, S. D. S. Abbi, D. K. Gupta, and Harish

Indian Geohydrology, Vol 5, No 1, p 26-43, Dec 1969. 18 p, 6 fig, 4 tab, 3 ref.

*Rainfall-runoff Descriptors: *Design storm, *Monsoons, *Synoptic analysis, *Duration curves, Depth-area-duration analysis, Hydrologic data, Flood forecasting, Runoff forecasting, Rainfall disposition, Distribution pat-

Identifiers: Assam (India).

More than 100 rainstorms of durations ranging from 1-day to 7-day during the period 1901-1960 over the Brahmaputra Catchment in the Assam Plains of India were studied by the Isohyetal method. Enveloping curves of maximum depths for various durations are presented and discussed. Preferred regions for occurrence of concentrated rainfall were located. The synoptic situations associated with some of the flood producing heavy storms are also discussed. Rainstorms are most frequent in the month of June. Most of the storms are of duration of 2-4 days. The synoptic situation which is associated with the maximum number of storms is the extension of the eastern end of the monsoon trough over Assam. Preferred areas for occurrence of storms are all in the northern part of the catchment close to the foot hills. (Knapp-W71-08095

PROBLEMS OF WATER SUPPLY FOR AGRICULTURAL OPERATIONS IN LOWER WEST BENGAL, Calcutta Univ. (India).

For primary bibliographic entry see Field 3F. W71-08099

USU TELEMETERING PRECIPITATION GAGE **NETWORK**

Utah State Univ., Logan. Coll. of Engineering. C. Earl Israelsen, and Don L. Griffin. Bureau of Reclamation Contract 14-06-D-6003. Utah Water Research Laboratory Report PRWG 39-7, Apr 1969. 39 p, 2 tab, 8 fig, 1 ref.

Descriptors: *Network design, *Climatic data, *Precipitation, *Telemetry, *Remote sensing, Utah, Wyoming, Idaho, Precipitation gages, Instrumentation, Data collections, Data processing, Data storage and retrieval, Monitoring, Data transmission, Sites, Installation, Operation and main-

Identifiers: Wasatch Weather Modification Project, Automatic Readout Console.

A network of telemetering precipitation gages, operating in mountainous northern Utah, western Wyoming and southern Idaho, is part of Wasatch Weather Modification Project. About 40 gages collected and reported data in the 1968-69 winter from up to 130 miles. The system includes an Automatic Readout Console from Mt. Logan to the Utah Water Research Laboratory. The console is

the control center for the network, responsible for interrogating, printing, and transmission. Site and gage selection is discussed with non-technical information on installation, operation and maintenance. (See also W71-08132) (Popkin-Arizona) W71-08131

TELEMETRY SYSTEM MODIFICATIONS AND

1968-69 OPERATION, Utah State Univ., Logan. Coll. of Engineering. Duane G. Chadwick.

Bureau of Reclamation Contract 14-06-D-6003. Utah Water Research Laboratory, Report PRWG 30-8, June 1969. 41 p, 7 fig, 4 tab, 4 ref.

Descriptors: *Network design, *Climatic data, *Precipitation, *Telemetry, *Remote sensing, Descriptors: "Network design, "Climatic data, *Precipitation, *Telemetry, *Remote sensing, Precipitation gages, Instrumentation, Data collec-tions, Data processing, Data storage and retrieval, Data transmission, Monitoring, Operation and Maintenance, Variability, Failures, Costs. Identifiers: Wasatch Weather Modification Project.

The Wasatch Weather Modification Telemetering System operation is summarized for the winter of 1968-69. The system is the largest known radio-reporting precipitation network in inaccessible mountainous regions. The system operated for about 600 hours from 39 stations. Mean value standard error was 0.016 inch and 0.03 inch of precipitation for the 36 inch and 70 inch capacity. precipitation for the 36-inch and 70-inch capacity precititation cans. Instruments were reliable, with 3 electronic failures, and 5 battery failures. Causes of failures were analyzed and remedied. Telemetering operation costs for the season were \$53,913 for indirect costs on salaries, \$8,665 for current expenses, and \$17,098 for taravel, or \$79,676 in total. Tables show station locations, operating records, telemetry logs, and estimates of standard error and variance. Figures show station locations, recorded data, data printout, transducer assembly, accuracy improvements, guide types, and rain-gage as-sembly. (See also W71-08131) (Popkin-Arizona) W71-08132

METEOROLOGY AND THE MIGRATION OF DESERT LOCUSTS: APPLICATIONS OF SYNOPTIC METEOROLOGY IN LOCUST CON-

TROL, World Meteorological Organization, Geneva (Swit-

For primary bibliographic entry see Field 03F. W71-08133

EVALUATION OF CLIMATOLOGICAL

RECORDS FOR RATIONAL PLANNING OF LIVESTOCK SHELTERS, Department of Agriculture, Columbia, Mo. Livestock Engineering and Farm Structures Research Branch; and Environmental Science Services Administration, Columbia, Mo. For primary bibliographic entry see Field 03F. W71-08144

2C. Snow, Ice, and Frost

AN ALGORITHM FOR NEEDLE ICE GROWTH. Michigan Univ., Ann Arbor. Dept. of Geography. Sam I. Outcalt.

Water Resources Research, Vol 7, No 2, p 394-400, Apr 1971. 7 p, 5 fig, 1 tab, 20 ref.

Descriptors: *Ice, *Frozen soils, *Freezing, *Mathematical models, Thawing, Frost, Frost action, Frost heaving, Heat transfer, Heat budget. Identifiers: *Needle ice, *Soil ice.

The morphology of needle ice growth is variable owing to entrapment of mineral soil particles, freezing plane depth, and banding. This paper attempts to link these morphologic variations to the needle growth environment by means of a simple algorithm. The algorithm is based on the hypothesis that morphologic variability can be traced to varia-

bility in surface energy transfer, soil water tension, and the thermal-hydraulic properties of the near-surface soil layers during needle evolution. (K-napp-USGS) W71-07912

MORPHOLOGY AND ABLATION PROCESSES ON GLACIER ICE.

Michigan Univ., Ann Arbor. Dept. of Geography. Stuart R. Loomis.

In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C., and Ragle, Richard H., eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 27-31, 1970. 5 p, 5 fig, 11 ref.

Descriptors: *Glaciers, *Glacial drift, *Ablation, Sedimentation, Sediment transport, Geomorphology, Sediments, Statistics, Surveys, Melting. Identifiers: *Kaskawulsh Glacier.

Differential ablation on debris-laden glacier ice has long been recognized for its importance in producing ice-cored topographical features. A study of ablation rates on a medial moraine of the Kashawulsh Glacier is used in conjunction with ice-flow data and an equilibrium hypothesis of mass movement in the debris mantle to explain the morphological form that the moraine assumes. At the broad head of the moraine, topographic relief under the thin moraine cover is low. In a downgla-cier direction, the relief increases along the moraine as the debris band narrows under the effects of lateral compression of ice along the juncture of the two ice arms. At the same time the till layer thickens and ablation rates decrease. After a few summer-melt seasons, the differential ablation occurring between the ice of the ice core below the moraine's debris mantle and the clean ice of the admoraine's debris manute and the clean ice of the adjacent glacier arms creates a prominent ice-cored moraine ridge standing above the surrounding glacier surface. The combination of slope steepening and ice-flow extension results in thinning and spreading of the debris veneer, particularly along the central ridge of the moraine. (Knapp-USGS)

THE COLLAPSE OF SOLIFLUCTION LOBES AS A FACTOR IN VEGETATION BLOCKFIELDS, Portland State Univ., Oregon. Dept. of Geography.

Larry W. Price.

Financial assistance for research was provided by Financial assistance for research was provided by the Arctic Inst of North America. This report previously appeared in Arctic, Vol 22, p 395-402, 1969. In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Ragle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 103-107, 1970. 5 p, 5 fig, 9 ref.

Descriptors: *Solifluction, *Glaciers, *Glacial drift, *Soil formation, Soil-water-plant relationships, Sedimentation, Vegetation establishment, Geomorphology. Identifiers: *Blockfields, *Felsenmeer.

The development of soil and vegetation in blockfields through normal processes is very slow. It is surprising, therefore, to find in the Ruby Range of southwest Yukon Territory, tongues and islands of vegetation occurring amidst certain blockfields. The collapse of solifluction lobes from upslope is suggested as the mechanism responsible. The lobes pass from the more gentle solifluction slope of the alb onto the steeper slope of the blockfields, and eventually become unable to maintain themselves because of steeper slope, change in composition of vegetation, and deeper active layer. Once the lobes do collapse, they flow downslope carrying with them clumps of vegetation which may become established somewhere along the mudflow channel or levee. In this way small outposts of vegetation are created and speed up a process which would otherwise take indeterminately longer. (Knapp-USGS) W71-07954

SEISMIC INVESTIGATION OF ICE PROPERTIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF THE NORTH AND CENTRAL ARMS OF THE KASKAWULSH GLACI-

Ohio State Univ., Columbus. Inst. of Polar Studies

Ohio State Univ., Columbus. Inst. of Polar Studies. Gilbert Dewart.
In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Ragle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 77-102, 1970. 26 p, 21 fig, 7 tab, 49 ref, append.

Descriptors: *Seismic studies, *Glaciers, *Ice, *Topography, Subsurface investigations, Structural geology, Movement, Crystallography, Seismic pro-

identifiers: *Ice properties, *Kaskawulsh Glacier.

Seismic velocity inhomogeneity and anisotropy were studied in strongly deformed glacier ice, and the form and dimensions of that part of a subglacial valley where two large temperate glaciers merge were determined. The investigations were carried out during the summers of 1964 and 1965 at the confluence of the north and central arms of the Kaskawulsh Glacier in the St. Elias Mountains. According to the results of wide-angle sciencia reflections and the statement of the statemen cording to the results of wide-angle seismic reflection measurements the mean vertical P-wave velocity in the glacier is 3.70 km/sec. At depths of 10-100 m the mean P-wave velocity is 3.63 km/sec, S-wave velocity is 1.74 km/sec and Poisson's ratio is 0.350. From 10-m depth to the surface the velocities of P and S waves decrease markedly to approximately 3.0 km/sec and 1.5 km/sec, respecapproximately 3.0 km/sec and 1.5 km/sec, respectively. It appears that velocity anisotropy is caused mainly by the foliation structure of alternating layers of clear and bubbly ice. When foliation is strong, velocity anisotropy from this cause predominates over velocity anisotropy due to crystallographic fabric. Crystallographic fabrics are seldom strong enough to cause significant velocity anisotropy. The greatest depth of ice in the central arm of the glacier and in the combined glacier is about 1000 m. The north arm is somewhat less deep. The base of the ice is lower than the glacier terminus. 40 km downglacier, but no bedrock terminus, 40 km downglacier, but no bedrock depression was found at the confluence. Both glacier arms are roughly parabolic in cross section.

There is no break in the slope of the valley wall where the glacier surface meets it. The valleys of the two arms merge at approximately the same junction at which the surface movements of the two glaciers merge into a uniform flow. (Knapp-USGS) W71-07955

DEFORMATION OF SURFACE ICE AT A GLA-CIER CONFLUENCE, KASKAWULSH GLACI-

Ohio State Univ., Columbus. Inst. of Polar Studies.

Ohio State Univ., Columbus. Inst. of Polar Studies. Peter W. Anderton.
In: Icefield Ranges Research Projection Scientific Results, Vol 2, Bushnell, Vivian C, And Ragle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 59-76, 1970. 18 p, 16 fig, 1 tab, 25 ref.

Descriptors: *Glaciers, *Movement, *Rheology, Velocity, Stress, Strain, Surveys, Structural geology, Petrofabrics.

Identifiers: *Kaskawulsh Glacier, *Ice deformation (Glaciers).

Measurements of surface velocity at the confluence of the north and central arms of the Kaskawulsh Glacier show a progressive change from independent profiles across each arm towards a unified profile across the combined glacier. Strain-rate determinations near the point of confluence show that the surface ice flows through a changing stress field equivalent to simple shear with an increasing component of transverse compression. The stress field across the median line is characterized by dominant transverse compression and concomitant longitudinal extension. Surface structures such as fractures, folds, foliation, and lineation are related to the stress field at the confluence. Changes in optic-axis fabrics of the ice are also correlated with

changes in the stress field near the point of confluence. Fabric symmetry probably reflects the symmetry of small-scale movements in the ice, particularly in fabrics where the optic-axis and noncrystallographic subfabrics are closely related in symmetry. (Knapp-USGS) W71-07956

DENSITY VARIATIONS IN ALPHINE SNOW, British Columbia Univ., Vancouver. Dept. of

Geology. Donald Alford.

Donald Alford.

Reprinted from Journal of Glaciology, Vol 6, p 495-503, 1969. In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Ragle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 51-57, 1970. 7 p, 6 fig, 11

Descriptors: *Snowpacks, *Density, *Distribution patterns, *Density stratification, Temperature, Topography, Snowfall, Firn, Slopes, Snow cover. Identifiers: *Snowpack density.

Stratigraphic studies of the annual snow layer in the Beartooth Mountains of south-western Montana and on Mount Logan in the St. Elias Range disclose a similar distribution density in the two areas. The average density of the pack, obtained by integrating a series of measurements taken at 5-10 cm vertical intervals over the total thickness of the annual layer, reaches a maximum value near a midpoint of the total elevation covered by each traverse and decreases lineraly toward the elevation extremes. A preliminary hypothesis relates the distribution of average snow-density values along slopes to a semi-stable zonation of near-surface air temperatures. (Knapp-USGS) W71-07957

OPTICAL MEASUREMENTS ON SNOW,

Army Cold Regions Research and Engineering Lab., Hanover, N.H.

Lab., Hanover, N.H.
Malcolm Mellor.
Reprinted from Cold Regions Research and Engineering Lab. Research Report 169, 1965. In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Ragle, Richard H, eds, American Geographical Society, New York and Arctic Institute of North America, Montreal, p 43-50, 1970. 8 p, 9 fig, 1 tab, 8 ref.

Descriptors: *Snow, *Optical properties, *Refractivity, Absorption, Remote sensing, Snow surveys, Ice, Solar radiation, Snowpacks, Albedo, Snowmelt

Spectral extinction measurements for the visual range were made on homogeneous snow samples prepared under controlled conditions, with snow density and grain size as variables. Comparative measurements were made on coarse-grained natural snow. Extinction coefficient was in the range 0.8 to 1.7 for fine-grained dense snow, and 0.16 to 0.37 for the coarse-grained snow. In the finegrained snow, where scattering is thought to be the dominant attenuating process, there is a general decline of the coefficient as wavelength increases from 0.4 to 0.7 microns. In the coarse-grained snow, where absorption becomes significant, spectral selection was slight, with a weak minimum in the region 0.5 to 0.6 microns. For a given density the coefficient decreases as grain size increases, the rate of change varying with wavelength. Spectral reflectance measurements on natural snow are reported, and attenuation data are interpreted to give surface reflectivity for fine-grained snow. Diffuse reflection from fine-grained snow is believed to have little spectral dependence in the visual range, but with coarse-grained snow reflectance is expected to become inversely dependent on wavelength. It is suggested that optical principles might be applied in the measurement of snow structure, and also for remote sensing of snow-covered terrain. (Knapp-USGS) W71-07958

Field 02—WATER CYCLE

Group 2C—Snow, Ice, and Frost

STRATIGRAPHIC STUDIES OF THE WINTER SNOW LAYER, MOUNT LOGAN, SAINT ELIAS RANGE.

Montana State Univ., Bozeman, and Army Cold Regions Research and Engineering Lab., Hanover,

N.H.
Donald Alford, and Charles Keeler.
Reprinted from Arctic, Vol 21, p 245-254, 1969.
In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Ragle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 37-42, 1970. 6 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Snow, *Stratigraphy, Snow cover, Surveys, Firn, Profiles, Cross-sections, Climatology, Topography. Identifiers: *Mount Logan.

A traverse study was made of near-surface snow properties in the King Trench area of Mount Logan, St. Elias Range. Based upon the assumption that these snow properties are related to thermodynamic processes appearing during the state. modynamic processes operating during the deposi-tional period, a climatological model of the King Trench relates the observed variations in snow properties along the traverse line to localized topographic obstruction or enhancement of katabatic air drainage. The near-surface climate of katautic air drainage. The near-surface climate of snow-covered slopes generally may be inferred partially from the interaction between local topography and katabatic flow. (Knapp-USGS) W71-07959

MICROCLIMATOLOGICAL STUDIES OVER THE SEWARD GLACIER SNOWPACK,

Michigan Univ., Ann Arbor. Dept. of Geography.

Michigan Univ., Ann Arbor. Dept. of Geography.
Ray Lougeay.
In: Icefield Ranges Research Project Scientific Results, Vol 2, Bushnell, Vivian C, and Rangle, Richard H, eds, American Geographical Society, New York, and Arctic Institute of North America, Montreal, p 17-26, 1970. 10 p, 5 fig, 7 tab, 24 ref.

Descriptors: *Microclimatology, *Glaciers, *Micrometeorology, *Air circulation, Winds, Meteorology, Regimen, Data collections, Instrumentation, Meteorological data, Solar radiation, Alaska, Weather.

Identifiers: *Icefield ranges, *Seward Glacier.

Microclimatic observations for a ten-day period in the summer of 1965 on the upper Seward Glacier show that wind profiles closely approximate log-linear curves, as would be expected under the stable conditions characteristic of the period. Temperature profiles have a distinct double inversion pattern during daytime hours. Net radiation is the dominant heat source during each day of the period, whereas sensible and latent heat fluxes were almost insignificant due to low wind speeds and limited temperature ranges, with temperatures generally close to 0 deg C. (Knapp-USGS) W71-07960

SNOW PREDICTION IN THE EASTERN UNITED STATES,

New York Univ., Bronx. School of Engineering and Science

Jerome Spar, Edward A. Brandes, and Joseph N.

Available from the National Technical Information Service as COM 71-00103, \$3.00 in paper copy, \$0.95 in microfiche. New York University, School of Engineering and Science, Geophysical Sciences Laboratory Report No TR-70-11, July 1970. ESSA Contract No E-4-70 (N).

Descriptors: *Synoptic analysis, *Forecasting, *Snow, *Snowfall, *Cities, Meteorology, Surveys, Reviews, Weather forecasting, Rainfall, Precipitation (Atmospheric).
Identifiers: *Urban hydrology, *Snow forecasting.

A climatological approach to the translation of synoptic-scale predictions of winter precipitation into mesoscale information was applied to the problem of rain-snow discrimination in the New

York metropolitan area. The synoptic conditions necessary for the occurrence of heavy snow on the east coastal plain show no obvious characteristic antecedent patterns either 24 or 12 hours prior to onset of snow, and a wide diversity of patterns even at and after onset time. Localized hourly numerical forecasts generated through spatial interpolation by the Shuman primitive equation model for the 1969-1970 winter season are evaluated for seven 1969-1970 winter season are evaluated for seven eastern cities, and are found to predict precipitation occurrences too infrequently and too late. This systematic error appears to be due, at least in part, to the method of interpolating precipitation. The results of the snow prediction project are reviewed from the viewpoint of forecast application. (Knapp-USGS)
W71-07968

SNOW FENCES, Road Research Lab., Crowthorne, England, Climate and Environment Section.

L. E. Hogbin. Available from the National Technical Information Service as PB-195 954, \$3.00 in paper copy, \$0.95 in microfiche. Ministry of Transport (Crowthorne, England), Road Research Laboratory Report LR 362, 1970. 27 p, 17 fig, 5 plate, 1 tab, 11 ref.

Descriptors: *Snowpacks, *Snowfall, *Snow, *Check structures, *Barriers, Construction, Methodology, Construction materials, Snow management, Meteorology. Identifiers: *Snow fences.

The mechanism of snow drifting and the action of a snow fence are described. A formula relating the siting of a fence to its height and construction is derived from experimental results. Recommendations are made for fence constructions including a portable fence, and for siting arrangements. (Woodard-USGS)

SUMMARY OF SNOW SURVEY MEASURE-MENTS FOR ARIZONA AND PERTINENT POR-TIONS OF NEW MEXICO 1939-1970,

Soil Conservation Service, Phoenix, Ariz. Richard W. Enz.

Soil Conservation Service Cooperative Snow Survey Report, 1970. 73 p.

Descriptors: *Snow surveys, *Arizona, *Colorado River basin, *Snow cover, Water equivalent, Soil moisture, Sampling, Methodology, Data collections, Hydrologic data, Streamflow forecasting, Water yield, Runoff forecasting, Water management (Applied).

Summarized are all snow survey measurements made in Arizona and western New Mexico from 1938 through 1970 for which records are available. This report superseded all previous Arizona summaries, as all data has been carefully checked and notes corrected to eliminate sampling errors. Some snow courses have been shortened since the 1964 summary, so there may be slight changes from the previously published record. Snow survey activities in Arizona started in 1937 with the establishment of six snow courses along the Coronado Trail near Alpine. These are all still active and used in forecasting the Salt and San Francisco Rivers. Throughout the years, many more courses were added to provide better sampling distribution. At present there are 55 active snow courses on the major watersheds of the state. Eight of these are located on the Gila River headwaters in New Mexico. After all sample points have been measured, the depth of snow and water content columns are totaled and then divided by the number of samples to obtain average snow depth and average water content. (Woodard-USGS) W71-08076

AIRCRAFT GAMMA-RAY SURVEY OF SNOW

Hydrometeorological Service of the USSR,

For primary bibliographic entry see Field 07B. W71-08085

POSSIBILITY OF PREDICTING WATER TURBIDITY AS ILLUSTRATED BY THE OKARIVER BASIN (RUSSIAN: O VOZMOZHNOSTI PREDSKAZANIYA MUTNOSTI VODY NA PRIMERE REK BASSEYNA OKI), For primary bibliographic entry see Field 02J. W71-08101

NEO-PLEISTOCENE CHANGES IN A LARGE RIVER VALLEY USING THE ORDER AS AN EXAMPLE,

Wroclaw Univ. (Poland). Inst. of Geography. Stanislaw Szczepankiewicz.
Geographia Polonica, No 14, p 23-33, 1968. 11 p, 4 fig, 13 ref.

*Pleistocene epoch, *Glaciation, Descriptors: relations of the second of the Gravels, Loes

Identifiers: *Poland, Oder River, Neo-Pleistocene relief, Inland ice, Aeolian processes.

In the Neo-Pleistocene relief of proximal valleys, several sections can be distinguished which differ in the evolution of their forms of accumulation and erosion. In the zone between the fringe of the Last Glaciation and the maximum range of glaciations Glaciation and the maximum range of glaciations no ice marginal valley of a continuous character exists; water runoff in a variety of directions is the rule, dictated by the ancient valley network. Results of the study show that in many instances there is lack of evidence for establishing uniformity between right and left bank forms of relief, particularly received to longitudinal profiles of river. larly with respect to longitudinal profiles of river valleys. The range of the Neo-Pleistocene glacia-tions clearly indicates a noncontinuity. Besides climatic and tectonic conditions, evolution of transverse and longitudinal valley profiles in the regions depends, among other things, upon local sedimentation. The Oder Valley may be viewed as a unique model for river valleys whose floors are oriented proximally with respect to movement of inland ice and which are situated within the range of two Pleistocene glaciations. (Josefson-USGS) W71-08107

THE ECONOMIC AND SOCIAL IMPLICA-TIONS OF SNOW AND ICE, Southern Illinois Univ., Carbondale.

For primary bibliographic entry see Field 06B. W71-08291

TEMPERATURE VARIATIONS IN A WATER RESERVOIR.

For primary bibliographic entry see Field 02H. W71-08320

2D. Evaporation and Transpiration

CARBON DIOXIDE AND WATER VAPOUR EXCHANGE IN ATRIPLEX LEAVES, Australian National Univ., Canberra. Research

School of Biological Sciences. R. O. Slatyer.

In, The Biology of Atriplex, Studies of the Australian Arid Zone, Symposium held in Deniliquin, NSW, Oct 14-15, 1969, p 24-29, Pub 1970. 1 tab, 6 fig, 2 ref, 3 equa.

*Transpiration, works, *Analog Descriptors: *Photosynthesis, *Soil gases, *Resistance networks, *Analog models, Water vapor, Water flow, Diffusion, Plant growth, Stomata, Carbon dioxide, Consumptive use, Water demand, Moisture content, Moisture stress, Equations.

Identifiers: *Atriplex, *Net flux, *Response curves, *Water-use efficiency, *Gas exchange, Herbs, Orache, Light-flux density.

Photosynthesis and transpiration in Atriplex (orache herb) are evaluated by analogy to an electrical analogue, where carbon dioxide net flux and water vapor where net water vapor flux is E, water are related to resistors. The transpiration equation is E equals (cw-ca)/ (ra plus ri), vapor concentration is cw at evaporation sites and ca in the bulk air, and leaf resistance is ri, and external resistance is ra. The photosynthesis equation is A equals (ca'cc')/ (ra' plus ri' plus rm), where A is net CO sub 2 flux, ca' and cc' are CO sub 2 concentrations in bulk air and cell, and ra', ri' and rm are resistance to CO sub 2 transport in air, gas phase of leaf, and within the cell. Characteristics of water vapor pathway are determined by cuticular and stomatal resistance. CO sub 2 response curves and water stress on CO sub 2 exchange are related to the model. Relative water-use efficiency of a species is indexed by rate of net photosynthesis relative to transpiration. Figures show a sketch to the model, pattern of stomatal resistance with light-flux density and ri with water content, CO sub 2 response curves, effect of water stress on photosynthesis, transpiration and water-use efficiency. (Popkin-Arizona) W71-07808

GLOBAL WATER BALANCE ACCORDING TO THE PENMAN APPROACH,

HE FENMAN APPROACH,
Hawaii Univ., Honolulu; and Pennsylvania State
Coll., State College.
Jen-Hu Chang, and Gary Okimoto.
ESSA Grant No E-44-67 (G). Contribution No 20,

Water Resources Research Center, Hawaii University. Geographical Analysis, Vol 2, No 1, p 55-67, Jan 1970. 3 fig, 1 tab, 60 ref.

Descriptors: *Evapotranspiration, *Climatic data, *Solar radiation, *Rainfall, *Water balance, Arid lands, Semiarid climates, Estimating equations. Identifiers: *Potential evapotranspiration, *Water deficit, *Water surplus.

The Penman and Thornthwaite approaches to potential evapotranspiration (PE) calculation are discussed and compared. It is felt that the Penman approach is based on sounder physical reasoning and yields more accurate data on both weekly and monthly bases. In spite of its accuracy, the Penman formula is complicated by the necessity of evaluating net radiation in terms of cloudiness or sunshine duration data. However, the original equation has been revised so that net radiation is estimated from solar radiation records instead of sunshine duration. Annual world PE values were calculated from the data of 394 stations, according to most data. The 2 methods yielded similar results from areas of relatively low annual solar radiation, but diverged with greater annual solar radiation, the greatest differences between the 2 methods being found in the semi-arid and arid tropics. Additionally Koppen classifications and Penman data show many divergencies which are greatest in tropical deserts. Globally, wet season water surpluses are much less Globally, wet season water surpluses are much less than dry season water deficits, and Penman estimates of water surplus are much lower than Thornthwaite estimates. Africa and Australia have the highest average PE's, and Europe has the lowest. For all 6 continents, PE exceeds rainfall, and the annual water deficit of 72 cms is only less than average rainfall by 3 cms. Water deficit ex-ceeds water surplus by a 1/5 ratio. (Casey-Arizona) W71-07809

EVAPOTRANSPIRATION FROM AN IR-RIGATED TURF UNDER ADVECTION OF DRY AIR AT DAVIS, CALIFORNIA, California Univ., Davis. Dept. of Water Science

California Univ., Davis. Dept. of water science and Engineering.

D. L. Morgan, W. O. Pruitt, F. J. Lourence, S. M. Goltz, and W. L. Decker.

Army Electronics Command, Atmospheric Sciences Lab Research and Development Report ECOM 68-G10-1, Feb 1970. 95 p, 24 fig, 23 tab, 29 ref, 2 append. USDA Grant DA-AMC-28-043-68-G10 DA Task No 1B062109A197-02.

Descriptors: *Evaporation, *Evapotranspiration, *Irrigated land, *Advection, *California, Methodology, Meteorological data, Instrumentation, Lysimeters, Infrared radiation, Winds, Model studies, Data collections, Latent heat, Vegetation, Soil-water-plant relationships.

Detailed micrometeorological data were collected during three periods in October 1966 and 1967 at Davis, California when dry northerly winds passed from an extensive dry area onto a moist irrigated grass field. The two studies which comprise this report use these data to test several advection models. Goltz and Pruitt, using 13-14 October 1966 data and three independent methods studied the horizontal extent of the transition zone of surface evaporative flux and the magnitude and varia-tion of evapotranspiration within this zone. The reduction of evapotranspiration 117 meters downwind from the leading edge of an irrigated grass field under conditions of strong advection of cool dry air was 20 to 25 percent, with all three methods providing compatible results. Indications were that even at this distance into the grass field, evapotranspiration reductions had not completely stabilized. Decker, using Philip's model for advection, tested the variation of evapotranspiration over the same irrigated grass field during conditions of mild advection of warm dry air represented by the 7 and 9 October 1967 data. He found that pre-dicted values of surface evapotranspiration during inversion periods compared quite closely to values of evapotranspiration measured by the 20-foot weighing lysimeter located 100 meters downwind in the grass field. During periods without surface temperature inversions, however, the lysimeter evapotranspiration was 20 to 60 percent higher than the evapotranspiration predicted by the advection model. (Woodard-USGS) W71-07971

EVAPORATION FROM WATER SURFACES BY DAY AND BY NIGHT, Marie Curie-Sklodowska Univ., Lublin (Poland).

Inst. of Geography. Edward Michna.

Geographia Polonica, No 14, p 159-164, 1968. 6 p, 3 tab, 9 ref.

Descriptors: *Evaporation, *Air-water interfaces, *Evaporators, *Meteorological data, Instrumentation, Measurement, Seasonal, Diurnal, Nocturnal. Identifiers: *Poland, Carpathian Mountains, Water

A quantitative determination of the amount of a quantitative determination of the amount of evaporation occurring by day and by night over a full 24-hour period is of great importance for hydrology and climatology. In investigating evaporation from a water surface the most appropriate period for nighttime evaporation must first be decided. The period between sunset and sunrise was picked in the belief that measurements made at the time the sun rises and sets would yield results which illustrate the true amount of evaporation during night and day. Evaporation from a free water surface was measured at the Research Sta-tion of the Physical Geography Laboratory of the Curie-Sklodowska University situated at Rownia (Western Bieszczady) and at the Meteorological Station of the State Hydrological and Meteorological cal Institute at Przemysl (the Carpathian Upland). Although measurements covered only a short period the results obtained indicate that nightly evaporation constitutes a large part of a 24-hour evaporation--particularly in the cooler season. It is believed that measurements of evaporation from water surfaces during the periods indicated yield true values of daytime and nighttime evaporation; calculated per hour of day and night, the values permit comparisons to be made between results obtained at various latitude sites. (Josefson-USGS)

AN ASPIRATED DIFFUSION POROMETER,

Commonwealth Scientific and Industrial Reasearch Organization, Canberra (Australia). Div. of Land

Research; and Australian National Univ., Canberra. Research School of Biological Sciences. G. F. Byrne, C. W. Rose, and R. O. Slatyer. Agricultural Meteorology, Vol 7, No 1, Jan 1970. 5

Descriptors: *Instrumentation, *Leaves, *Dif-Descriptors: Institutional State of Control of Control

The large aspirated diffusion porometer for measurement of leaf diffusive dimensions is accurate under laboratory conditions, but field conditions cause temperature gradients within the instrument, impairing its performance. Also, leaves of large dimensions must be used in taking measurements. A porometer designed for field use, which can also take measurements from small leaves, has been developed. The small interior volume of the instrument prevents temperature gradients from developing within it. Three detailed diagrams of the instrument, directions for its use, and formula for calculation of leaf diffusive resistance are included. (Yensen-Arizona) W71-08143

THE SEASONAL MARCH OF THE SPATIAL PATTERN OF GLOBAL AND NET RADIATION IN WEST AFRICA,

Chicago Univ., Ill. Simon Oyediran Ojo.

Journal of Tropical Geography, Vol 30, p 48-62, June 1970. 11 fig, 3 tab, 40 ref.

Descriptors: *Solar radiation, *Evapotranspiration, *Heat balance, Meteorology, Albedo, Estimating equations, Energy balance, Evaporation, Rainfall, Temperature, Humidity, Seasonal, Infrared radiation, Climatic zones, Climatology, Arid lands, Semiarid climates, Tropical regions, Boundary layers, Vegetation effects, Model studies, Geographical regions, Latitudinal studies, Mapping,

Identifiers: *West Africa, *Sahara Desert, *Potential evapotranspiration, *Net radiation, *Bowen

There are many gaps in the current knowledge of radiational processes over the horizontal surface of West Africa. Little radiation data is available for the area and a theoretical model was therefore utilized which was based largely on indirect calculations using ordinary meteorological data. Total solar radiation consists of direct radiation (Q) and diffuse radiation (q). Observed solar radiation (Q and q) could be estimated with an equation utilizing data for maximum possible solar radiation, maximum possible sunshine hours and observed sunshine hours. Mean monthly values of Q and q were then mapped as isolines for West Africa in the months of January and July. Surface solar energy ranges from 500-275 ly/day. In both months, lowest values were along the Guinea coast due to cloud cover, while highest values were along the fringes of the Sahara. Zonal distribution patterns prevailed and are detailed. In July, longer day lengths prevailed, but this was offset by greater cloud cover so that average values were not very different from January. Net radiation (R)— (Q and q) (I-a) - I where a is albedo and I is effective outgoing radiation. Methods are presented for the estimation of I. Maps of R were constructed for alternate months of the year, and temporal and zonal fluctuations are discussed. Definite relationships exist between the heat balance components and both the water balance and hydrological cycle components. Equations are developed relating radiation terms to water balance and hydrological cycle terms. (Casey-Arizona) W71-08148

Group 2E—Streamflow and Runoff

2E. Streamflow and Runoff

DATA ERROR EFFECTS IN UNIT HYDRO-GRAPH DERIVATION (Discussion), For primary bibliographic entry see Field 07A. W71-07842

SURFACE RUNOFF FROM GRADED LANDS

OF LOW SLOPES,
J. M. Laflen, and I. L. Saveson.
Trans Am Soc Agricultural Engrs, Vol 13, No 3, p
340-341, 1970. 4 fig, 2 ref.

Descriptors: *Mathematical studies, *Data collections, *Surface runoff, Estimating equations, Storms, Louisiana.
Identifiers: *Data analysis, Baton Rouge (La).

This paper reports on analysis of surface runoff data collected during 1962, 1963, and 1964 near Baton Rouge, La. The object of the data analysis was to develop reliable prediction equations for estimating peak rate and total amount of surface runoff from any storm. The hypothesis tested was that peak rate and total amount of surface runoff could be expressed as functions of precipitation, row slope, row length, and antecedent soil row slope, row length, and antecedent soil moisture. Some conclusions drawn from the experimoisture. Some conclusions drawn from the experiment include: (1) the effect of antecedent soil moisture is independent of precipitation, if the peak rate of runoff is the dependent variable; (2) the effect of slope and length of surface runoff is not independent of precipitation; (3) a single, precipitation - intensity measure is sufficient for expressing the effect of precipitation on peak rate of surface runoff surface runoff. W71-07843

A PROPOSAL OF CLASSIFICATION OF VEGETATION HABITATS ON THE BANKS OF CZECHOSLOVAK WATER COURSES FROM THE HYD GERMAN), HYDROLOGICAL STANDPOINT, (IN

Ceskoslovenska Akademie Ved, Prague. Botanicky Ustav.

Ostav. Karel Kopecky. English abstract. Archiv fur Hydrobiologie, Vol 66, No 3, p 326-347, 1969. 9 fig, 19 ref.

Descriptors: *Streams, *Rivers, *Banks, *Aquatic plants, *Streamflow, Hydraulics, Water levels, Floodwater, Velocity, Marshes, Flood plains, Erosion, Deposition (Sediments), Classification.

The proposed classification considers the vertical zonality of stream shores, the fluctuation of water level, and the rate of water movement of water courses. Depending on the position of the land and the extent of overflow, limited and broad inundation sites are recognized. Both groups are subdivided into marshes or quagmires, and flood plains of 3 degrees of inundation intensity and duration. The shores of water courses are further subdivided on the basis of the nature of denudation and deposition of eroded material. Within the substrata of comparable nutrient supply and outside the dif-fusion zone, the described sites support charac-teristic plant covers. (Wilde-Wisconsin) W71-07879

COMPUTER DETERMINATION OF THE GEOMETRY AND TOPOLOGY OF STREAM NETWORKS.

Purdue Univ., Purdue Univ., Lafayette, Ind. Dept. of Geosciences; and Toronto Univ. (Ontario). Dept. of Civil Engineering.

For primary bibliographic entry see Field 07A.

A METHOD FOR CHARACTERIZING THE RUNOFF POTENTIAL OF RAINFALL IN WATER HARVESTING SCHEMES,

Hebrew Univ., Rehovoth. Faculty of Agriculture. For primary bibliographic entry see Field 03B. W71-07913

REDUCING EXCESS READOUTS FROM DIGITAL STREAMFLOW RECORDERS, Rocky Mountain Forest and Range Experimental Station, Tempe, Ariz. Hydrology Lab. For primary bibliographic entry see Field 07C. W71-07914

AN AUTOMATIC OUTFLOW MEASURING DEVICE,

Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Riverina Lab.

For primary bibliographic entry see Field 07B. W71-07917

FLOODS IN PATILLAS-MAUNABO AREA, PUERTO RICO,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07926

FLOODS IN SALINAS AREA, PUERTO RICO, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07929

WATER-RESOURCES RECONNAISSANCE OF A PART OF THE MATANUSKA-SUSITNA BOROUGH, ALASKA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C.

FLOODS IN GUAYAMA AREA, PUERTO RICO, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07931

FLOODS IN SANTA ISABEL AREA, PUERTO

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07932

FLOOD PLAIN INFORMATION, BAYOU METO AND TRIBUTARIES, JACKSONVILLE ARKAN-

Corps of Engineers, Vicksburg, Miss. For primary bibliographic entry see Field 04A. W71-07933

FLOOD PLAIN INFORMATION, MIDDLE FORK FORKED DEEP RIVER AND TRIBUTARIES, VICINITY OF HUMBOLDT, TENNESSEE. Corps of Engineers, Memphis, Tenn. For primary bibliographic entry see Field 04A.
W71-07934

PRECIPITATION AND RUNOFF, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07936

LONG-RANGE FORECASTS OF RUNOFF FROM MOUNTAIN RIVERS OF SIBERIA (RUS-SIAN: DOLGOSROCHNYYE PROGNOZY STOKA GORNYKH REK SIBIRI), For primary bibliographic entry see Field 04A. W71-07946

COMPUTATIONS OF WATER DISCHARGES IN RIVERS FROM A BASIN WATER YIELD (RUSSIAN: RASCHETY RASKHODOV VODY V REKAKH PO VODOOTDACHE S BASSEYNA), V.I. Moklyak.

Gidrologicheskiye issledovaniya i raschety, Ukrain-Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 85, Moscow, p 3-10, 1969. 8 p, 4 fig, 4 tab, 7 ref. Descriptors: *Discharge (Water), *Water yield, *Time lag, *Inflow, Runoff, Hydrographs, Equations, Model studies, River basins. Identifiers: *Ukraine, River basin yield, Travel

An analysis of runoff formation in rivers with a time lag in excess of one day has established that in refined genetic runoff formulas depths of daily in flow are determined from water yield for a 2-3 day period. The depth of inflow consists of a layer of water yield for which a coefficient may be calculated; for approximate computations it may be assumed that it is between 0 and 0.3. An example of a computation is given, which confirms the expediency of taking into account the nonsimultaneous lag of a slope and channel runoff within a daily time period. For computation purposes, discharges of spring high water from the Kleven' River near Sharpovka for the year 1940 have been used. (Josefson-USGS) W71-07947

HYDROLOGICAL FORECASTS AND MODERN

COMPUTERS,
Gidromteorologicheskii Nauchno-Inssledovatelsii
Tsentr, Moscow (USSR).
For primary bibliographic entry see Field 04A.
W71-07948

ROMANIAN RIVERS, HYDROLOGIC MONOGRAPH (RIVRILE ROMANIEI, MONOGRAFIE

HIDROLOGICA),
Institute of Meteorology and Hydrology,
Bucharest, Romania. Institutul de Metrologie,
Bucharest (Rumania).

Constantin Diaconu, and Sorin Stanculescu.
Summaries in English, French, Russian and Spanish. Institutul de Meteorologie si Hidrologie, Bucharest, 1971. 750 p.

Descriptors: *Rivers, *Surveys, *Streamflow, *Hydrologic data, Data collections, Hydrography, Surface waters, Water balance, Runoff, Water quality, Water yield, Sediment transport, Bed load, Suspended load, Water chemistry, Stream gages, Networks, Gaging stations, Hydrogeology. Identifiers: *Romania.

This hydrological monograph of Romanian rivers is the result of five years of activity from 1964 to 1969. The hydrographic problems of the river net-work of Romania are outlined. Present hydrologi-cal knowledge of runoff, suspended and bed-load transport, water temperature, frost phenomena, water balance, and chemistry are discussed and tabulated. The monograph consists of the following parts and chapters: watercourses network; review of research on Romanian rivers; present stage of hydrological knowledge; runoff and physiographi-cal conditions of runoff generation; river runoff regime; river supply sources; mean runoff; maximum runoff; minimum runoff; suspended and bedload transport; water temperatures and frost phenomena; water balance; water chemistry; biological aspects, hydrological parameters for the major rivers; theoretical and practical bases for making hydrological forecasts; and trends of future research. (Knapp-USGS)
W71-07950

HYDROLOGIC COMMUNICATIONS EXPERIMENT ON THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-1), Environmental Science Services Administration,

For primary bibliographic entry see Field 07B. W71-07962

APPLICATION OF COMPUTER PROCESSED MULTISPECTRAL DATA TO THE DISCRIMINATION OF LAND COLLAPSE (SINKHOLE) PRONE AREAS IN FLORIDA, Geological Survey, Tampa, Fla.; and Michigan Univ., Ann Arbor. Infrared and Optics Lab.

For primary bibliographic entry see Field 07B. W71-07963

Streamflow and Runoff—Group 2E

A PROPOSED STREAMFLOW DATA PROGRAM FOR SOUTH CAROLINA, Geological Survey, Columbia, S. C. For primary bibliographic entry see Field 07A. W71-07970

FLOOD STAGES AND DISCHARGES FOR SMALL STREAMS IN TEXAS, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W71-08047

STATES, 1961-65: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA, VOL 2, BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY. Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-08048 SURFACE WATER SUPPLY OF THE UNITED

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 12. PACIFIC SLOPE BASINS IN WASHINGTON, VOL. 1. PACIFIC SLOPE BASINS IN WASHINGTON EXCEPT COLUMBIA RIVER HASIN. Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-08049

APPLICATION OF AN ACOUSTIC STREAM-FLOW-MEASURING SYSTEM ON THE COLUMBIA RIVER AT THE DALLES,

OREGON, Geological Survey, Menlo Park, Calif. Winchell Smith.

Water Resources Bulletin, Vol 7, No 1, p 69-78, Feb 1971. 10 p, 7 fig.

*Flowmeters, *Columbia River, Descriptors: *Stream gages, *Discharge measurement, Open channel flow, Gaging stations, Velocity, Acoustics, Instrumentation, Current meters, Discharge (Water), Streamflow.

Identifiers: *Flowmeters (Acoustic).

To collect accurate, independent records of flow on the Columbia River at The Dalles, Oregon, an acoustic streamflow-measuring system was in-stalled. This device measures velocity of flow by the difference in traveltimes of acoustic pulses transmitted through the water in each direction along a diagonal path across the river. The flow of water along the path increases the speed of one signal and retards the speed of the other. The difference in time of travel is related linearly to the water velocity along the path. Installation of the system, which is the first application of an acoustic flowmeter in a large natural channel, was completed in April 1969. It has been in continuous operation since that date. The velocity index and water-surface elevation are used as a two-variable index in the computation of flow. These variables, correlated against current-meter measurements made by use of specialized boat equipment, provide a reliable basis for computations of instantaneous and daily mean discharges. (Knapp-USGS) W71-08056

THE CHANCE A FLOOD WILL BE EXCEEDED IN A PERIOD OF YEARS,

Soil Conservation Service, Berkeley, Calif. Watershed Planning Party.
For primary bibliographic entry see Field 06A.
W71-08058

THERMAL MAPPING OF STREAMS FROM AIRBORNE RADIOMETRIC SCANNING,

Purdue Univ., Lafayette, Ind. Dept. of Geosciences; and Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing. For primary bibliographic entry see Field 07B. W71-08061

STUDY OF WATERSHED CHARACTERISTICS

AFFECTING THE HYDROLOGIC PER-FORMANCE, India Inst. of Tech., Kharagpur. Dept. of Agricul-tural Engineering; and Soil Conservation Research, Training and Demonstration Center, Ootacmund

N. K. Tyagi, E. Raghunath, and V. Lekhmanan. Journal of Soil and Water Conservation in India, Vol 18, Nos 1 and 2, p 7-12, Jan-June 1970. 6 p, 6

criptors: *Rainfall-runoff relationships, *Water yield, Topography, Drainage density, Drainage pat-terns (Geologic), Rainfall disposition. Identifiers: *India.

The physiographic characteristics of watersheds affecting the peak flows and runoff yield are reviewed and evaluated. Hydrologic performance of two watersheds in the Nilgiris, India, are compared. The two watersheds selected for study show significant difference in runoff yield. The rainfall received by Kallarpallam is only 22% more than Kukkalhariahalla but the runoff is greater by 83%. Due to the insignificant difference in climatic varia-Kukkalhariahaila but the runoff is greater by 83%. Due to the insignificant difference in climatic variables the marked variation in hydrologic performance can be attributed only to physiographic factors such as total watershed relief, stream slope and drainage density. (Knapp-USGS) W71-08072

FLOODS IN THE WAPSIPINICON RIVER BASIN, IOWA,

Geological Survey, Iowa City, Iowa. Harlan H. Schwob.

Geological Survey Open-file Report, Feb 1971. 52 p, 2 fig, 19 plate, 2 tab, 6 ref.

Descriptors: *Floods, *Flood plains, *Flood forecasting, *Iowa, Hydrologic data, Rainfall-runoff relationships, Stream gages, Flow rates, Peak discharge, Historic flood, Flood control, Regional flood, Data collections.

Identifiers: Flood profiles, Standard Project Flood, Intermediate Regional Flood.

Flood information for 338 miles of the main stem and six tributaries of the Wapsipinicon River, Iowa is reported to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Included are flood-peak records, gaging-staremely heavy rainfall occurred in the upper basin in 1968 and 1969. Those in 1968 produced the highest flood of record at the gaging station at Independence. The flood of 26,800 cfs (cubic feet per second) at this station was the greatest in the period 1933-70. A number of the smaller tributaries experienced floods more than five times the computed 50-year flood. No flood of record has exceeded the 50-year flood on the main stem from Anamosa. Flood-profile sheets show actual flood occurrences and computed profiles of the 25- and 50-year floods. A low-water profile and tabulated discharge indicate the range in elevation and discharge along the streams. (Woodard-USGS) W71-08081

COMPARISON OF DIMENSIONLESS UNIT HYDROGRAPHS IN THAILAND AND TAIWAN, Colorado State Univ., Fort Collins; and Asian Inst. of Tech., Bangkok (Thailand); and National Energy Authority, Bangkok (Thailand).
Edmund F. Schulz, Subin Pinkayan, and Chumporn

Komsartra.

Nordic Hydrology, Vol 2, No 1, p 23-46, 1971. 24 p, 16 fig, 2 tab, 21 ref.

Descriptors: *Unit hydrographs, *Rainfall-runoff relationships, *Mathematical models, Hydrograph analysis, Base flow, Floods, Subsurface runoff, Hydrographs, Peak discharge, Time lag, Tropical Identifiers: *Thailand, *Taiwan.

The characteristics of dimensionless unit hydrographs were derived from floods from watersheds smaller than 1000 square kilometers in Thailand. smaller than 1000 square kilometers in Thailand. These dimensionless unit hydrographs were compared with similar unit hydrographs derived from floods on Taiwan and with the unit hydrographs derived from a mathematical model developed from the theory of the instantaneous unit hydrograph. The unit hydrographs derived from the Thai watersheds had much longer base length and much longer time to peak than similar unit hydrographs derived from floods on Taiwan. This increase in length of response time is attributed to a larger component of subsurface runoff in the floods from tropical watersheds. (Knapp-USGS)

THE BRAHMAPUTRA DRAINAGE SYSTEM

AND FLOODS IN THE ASSAM VALLEY, Assam Directorate of Geology and Mining (India). K. C. Prasad, and M. N. Talukdar. Indian Geohydrology, Vol 5, No 1, p 44-49 Dec 1969. 6 p, 2 fig.

Descriptors: *Floods, *Silting, *Rainfall-runoff relationships, *Rivers, *River flow, Hydrographs, Flood forecasting, Flood control, Hydrograph analysis, Flood plains, Earthquakes, River forecasting, Streamflow forecasting, Routing, Watersheds

Identifiers: *Brahmaputra River (India), *Assam Valley (India).

The Brahmaputra drainage basin of India has a catchment area of about 423,462 sq.km. falling catchment area of about 423,462 sq.km. falling mostly in the Himalayan, Assam, Naga and Barail Ranges. Precipitation in the entire catchment is heavy. Due to high gradient and drainage density in the catchment area the surface runoff quickly reaches the Brahmaputra, very often causing floods in the alluvial plains of Assam during the monsoon. Because of the earthquake of 1950, the bed of the Brahmaputra was silted up a few meters. This results in frequent spilling of the flood water over the Assam plains. The discharge hydrographs of the Brahmaputra show a very close relation to the rate of precipitation. Recent construction of embankof precipitation. Recent construction of embankments along the major tributaries of the Brahmaputra helped to enhance discharge and velocity of flow of water along these tributaries. (Knapp-USGS) W71-08096

A BASIC HYDROLOGIC FORECAST OF THE DISTRIBUTION OF RUNOFF FROM MOUNTAIN RIVERS DURING A GROWING SEASON (RUSSIAN: FONOVYY PROGNOZ RASPREDELENIYA STOKA GORNYKH REK V VEGETATSIONNYY PERIOD), MOSCOW STATE Univ. (USSR).

Meteorologiya i Gidrologiya, No 12, p 59-64, Dec 1970. 6 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Runoff forecasting, *River forecasting, *Runoff coefficient, *Hydrologic data, Distribution patterns, Seasonal, Air circulation, Watersheds (Basins).

Identifiers: *USSR, Caucasus, Runoff distribution.

The forecast of monthly distribution of runoff during the warm season, April through September, is of great value to the irrigation farming regions. To describe the monthly distribution of runoff, the ratio of the runoff during winter high water to the runoff of the following warm period is used. A continuity of atmospheric processes between spring and the preceding winter is assumed in establishing a relationship between variations in runoff distribution within a growing season and the character of atmospheric circulation. Annual values of atmospheric circulation from November through March are expressed as a percentage of the number of days in this five-month period. Given the number of days with meridional and western circulation, one can determine the extent to which the distribution of runoff during a growing season will deviate

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

from the average distribution for all rivers in from the average distribution for all rivers in question. A basic hydrologic forecast of total runoff for a growing season will also make it possible to obtain absolute monthly runoff values for specific rivers. For developing the forecast, studies were conducted on the Terek River basin at which 15 partial basins with runoff values for a 25-year period (1939-1941 and 1945-1966) were identified. (Josefson-USGS) W71-08100

EFFECT OF FLAT BOG DRAINAGE ON THE RUNOFF REGIME OF SPRING HIGH WATER AND SUMMER FLOODS (RUSSIAN: VLIYANIYE OSUSHENIYA NIZINNYKH
BOLOT NA REZHIM STOKA VESENNEGO
POLOVOD'YA I LETNIKH PAVODKOV),
Ministry of Land Reclamation and Water
Economics, Minsk (USSR). For primary bibliographic entry see Field 04A. W71-08103

SELECTED WATER RESOURCE RECORDS FOR OKALOOSA COUNTY AND ADJACENT AREAS,

Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 07C. W71-08114

LOW-FLOW FREQUENCY OF WISCONSIN

STREAMS, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-08115

SELECTED FLOW CHARACTERISTICS OF FLORIDA STREAMS AND CANALS, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 07C. W71-08119

EFFECTS OF CHANNEL CHARACTERISTICS ON TIME PARAMETERS FOR SMALL WATERSHED RUNOFF HYDROGRAPHS, Minnesota Univ., Minneapolis. Water Resources

Research Center.

For primary bibliographic entry see Field 02A. W71-08121

RANDOM-WALK MODEL OF STREAM NET-WORK DEVELOPMENT,

IBM Watson Research Center, Yorktown Heights,

For primary bibliographic entry see Field 07A. W71-08190

2F. Groundwater

USE OF LINEAR PROGRAMING FOR ESTI-MATING GEOHYDROLOGIC PARAMETERS OF GROUNDWATER BASINS,

General Electric Co., Santa Barbara, Calif. Center for Advanced Studies

For primary bibliographic entry see Field 06A. W71-07704

LEACHING OF NUTRIENTS BY DRAINAGE

Litovskaya Selskokhozyaistvennaya Akademiya SSR, Kaunas

For primary bibliographic entry see Field 05B. W71-07887

OPTIMAL USE OF COUPLED LEAKY AQUIFERS.

New Mexico Inst. of Mining and Technology, Socorro.

For primary bibliographic entry see Field 04B. W71-07916

AND GROUNDWATER **GEOLOGY** RESOURCES OF ELLSWORTH COUNTY, CEN-

TRAL KANSAS, Kansas State Geological Survey, Lawrence. Charles K. Bayne, Paul C. Franks, and William

Kansas Geological Survey Bulletin 201, Mar 1971. 84 p, 26 fig, 2 plate, 6 tab, 108 ref.

Descriptors: *Kansas, *Water resources development, *Glacial drift, *Aquifers, *Artesian wells, Water wells, Data collections, Hydrologic data, Hydrology, Groundwater recharge, Natural recharge, Subsurface waters, Porosity, Porous media, Soil water, Underground storage, Water wells, Springs, Mineral water.

Identifiers: *Ellsworth County (Kans), *Kansas

River, *Kansas River basin.

Ellsworth County comprises an area of about 720 square miles. The county lies in the Dissected High Plains section of the Great Plains physiographic province and is drained by the Smoky Hill River and its tributaries and tributaries of the Saline and Arkansas Rivers. The topography slopes generally eastward. The long-term mean precipitation at Ellsworth, the county seat, is 25.66 inches. The Dakota Formation and the Pleistocene deposits in the valleys are the most important aquifers in the county. The lithology most characteristic of the Dakota Formation is gray and greenish-gray siltstone and clay showing red and reddish-brown mottles. These groundwater reservoirs are recharged principally from local precipitation. Yields of properly constructed wells may be in excess of 250 gallons per minute in the most productive areas. The results of chemical analyses indicate that the water generally is suitable for most uses; however, the quality varies considerably from place to place, and locally a large amount of chloride is present. An appendix is included which contains a record of 311 wells and springs located within the county in addition to the well logs of 117 test holes. (Glasby-W71-07920

DRILLING TEST HOLES FOR IRRIGATION WELLS.

For primary bibliographic entry see Field 04B. W71-07922

GROUNDWATER FOR IRRIGATION NEAR LAKE EMILY, POPE COUNTY, WEST-CENTRAL MINNESOTA, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 04B. W71-07923

GROUNDWATER HYDROLOGY OF THE MESCALERO APACHE INDIAN RESERVA-TION, SOUTH-CENTRAL NEW MEXICO, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C.

GROUNDWATER RESOURCES OF WALSH COUNTY, NORTHEASTERN NORTH DAKOTA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07928

WATER-RESOURCES RECONNAISSANCE OF A PART OF THE MATANUSKA-SUSITNA BOROUGH, ALASKA,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W71-07930

GROUNDWATER, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07937

SALINE GROUND-WATERS IN THE CARBONIFEROUS ROCKS OF THE ENGLISH EAST MIDLANDS IN RELATION TO THE GEOLOGY, Water Resources Board, Reading (England); and British Petroleum Co., Ltd., London (England). Richard Allen Dowing, and Frank Howitt. Quarterly Journal of Engineering Geology, Vol 1, No 4, p 241-269, June 30, 1969. 29 p, 12 fig, 3 tab, 25 ref, append.

Descriptors: *Hydrogeology, *Groundwater, *Carbonate rocks, *Salinity, *Drill holes, Oil industry, Water quality, Limestones, Aquifers, Aquifer characteristics, Chlorides, Sampling, Chemical analysis, Data collections.

Identifiers: *England (East Midlands).

25 ref, append.

The Carboniferous system in the East Midlands of England is comprised of a limestone-shale series or a massive limestone (the Carboniferous a massive limestone (the Carboniferous Limestone) overlain by a cyclic sequence of sandstones, mudstones, seat-earths and coals (the Millstone Grit and Coal Measures). The geology is described briefly and modifications are made to correlations of the Millstone Grit and Lower Coal Measures from information obtained by deep drilling for oil. Most of the Carboniferous groundwaters discussed are saline with total concentrations in all 100 mg/l. The concentration in all tions up to 246,000 mg/l. The concentration in all formations increases from the Eakring-Kelham Hills area towards Gainsborough, that is from sw to ne, and the variation in ionic content associated with this increase is discussed. The groundwaters are believed to have originated from the diagenesis of Carboniferous marine and brackish waters and possible some Permian marine waters. They have probably been concentrated by argillaceous beds acting as semipermeable membranes and the in-crease in the Ca/Cl and Mg/Cl ratios as the total crease in the Ca/CI and Mg/CI ratios as the total ionic concentaration increases is probably due to the selective concentration of calcium and magnesium ions by argillaceous beds. In the southwest and south of the East Midlands the saline water has been diluted, probably by meteoric water moving through the aquifers from the outcrop areas and discharging into Permo. Trisssic rocks, where these discharging into Permo-Triassic rocks, where these overlie Carboniferous aquifers at depth in the southeast of the region. (Woodard-USGS) W71-07965

RELATION OF FRACTURE TRACES, JOINTS AND GROUNDWATER OCCURRENCE IN THE AREA OF THE BRYANTSVILLE QUADRANGLE, CENTRAL KENTUCKY, Kentucky Univ., Lexington. Dept. of Geology. George T. Hine.

Kentucky Geological Survey Thesis Series 3, 1970. 27 p, 21 fig, 16 ref.

Descriptors: *Karst, *Kentucky, *Fractures (Geology), *Joints (Geology), Limestones, Hydrogeology, Groundwater movement, Water supply, Water resources development, Remote sensing, Aerial photography, Mapping, Surveys. Identifiers: *Bryantsville (Ky).

Fracture traces (natural linear features visible on aerial photographs), joints, and groundwater oc-currence were studied in detail in a limestone area of approximately 48 square miles in the Inner Blue Grass region of Kentucky. Twenty-four hundred fracture traces, several hundred joints, and nu-merous wells and springs were related. Fracture traces exhibit orientation patterns similar to joint patterns and form as the result of the enlargement of joints by groundwater solution. Springs usually occur along fracture traces, and wells drilled near fracture traces encounter solution openings at depth. Most subsurface water movement in the area is probably along vertical fractures, either joints or faults. (Knapp-USGS) W71-08077

GEOHYDROLOGICAL SET-UP OF EASTERN

Geological Survey of India, Calcutta. Amit Kumar Roy.

Indian Geohydrology, Vol 5, No 1, p 65-70, Dec 1969, 6 p.

Descriptors: *Hydrogeology, *Aquifers, *Water resources, Reviews, Surveys, Aquifer characteristics, Water resources development, Water supply, Alluvium, Sedimentary rocks, Igneous rocks, Metamorphic rocks, Geology, Climates, Groundwater, Water levels, Water yield. Identifiers: India.

Geohydrologically, Eastern India can be divided into three units, namely, (1) areas covered by consolidated formations, (2) areas covered by semiconsolidated formations and (3) areas covered by unconsolidated formations. Major parts of Bihar, Orissa, Assam and western parts of West Bengal are covered by consolidated and semi-consolidated are covered by consolidated and semi-consolidated rocks like gneisses, schists, granulites, granites, gabros, basaltic traps, and sedimentary rocks of Vindhyan, Gondwana and Tertiary age. Unconsolidated formations of Quartarnary age cover parts of Bihar, Orissa, Assam and major parts of West Bengal and form the main repository of groundwater in the region. Groundwater conditions in the areas covered by the unconsolidated formations are discussed under (a) alluvial tracts of Bihar, (b) alluvial tracts of West Bengal, (c) Brahmaputra valley of Assam, (d) coastal tract of Orissa and (e) areas covered by the unconsolidated and poorly consolidated sediments in Manipur Valley and Tripura. (Knapp-USGS) W71-08097

GEOLOGY AND GROUNDWATER CONDITIONS OF THE ALLUVIAL TRACT, EAST OF DURGAPUR, BURDWAN DISTRICT, WEST BENGAL - A PRELIMINARY STUDY, Geological Survey of India, Calcutta. S. Das, and A. B. Biswas. Indian Geohydrology, Vol 5, No 1, p 71-89, Dec 1969. 19 p, 4 fig, 1 tab, 3 ref.

Descriptors: *Hydrogeology, *Hydrologic data, *Aquifers, *Aquifer characteristics, *Water resources development, Alluvium, Sands, Water table, Artesian wells, Water yield, Water supply, Drawdown. Identifiers: *India, Bengal (India).

Recent exploratory drilling in the alluvial areas, east of Durgapur, India, revealed the occurrence of unconsolidated sediments ranging in age from Middle Cretaceous to Pleistocene, overlying a semiconsolidated basement of the Lower and Upper Gondwanas. These sediments increase in thickness from 31 m in the west to more than 177 m in the east. The sand and pebble zones belonging to the Kuldiha, Alinager and Bishtupur formations constitute the promising aquifers in the area. Groundwater occurs under water-table conditions in the shallow aquifers and under semiconfined to confined conditions in the deeper aquifers. The depths to water table below landsurface range from 2 to 4 m in winter and 3 to 8 m in summer. Production wells already in operation in the area sustain a yield of 204,113 to 104,557 liters per hour with drawdowns of 6.1 to 7.1 meters. (Knapp-USGS)

DUNES ON THE PLAINS - THE SAND HILLS REGION OF NEBRASKA,

Geological Survey, Lincoln, Nebr. C. F. Keech, and Ray Bentall.

Nebraska University, Conservation and Survey Division Resource Report No 4, Feb 1971. 18 p, 7 fig. 21 ref.

Descriptors: *Water resources development, *Nebraska, *Grasslands, *Dunes, *Land resources, Groundwater, Water balance, Sands, Land development, Subhumid climates, Surface waters, Water supply, Water yield. Identifiers: *Sand Hills (Nebr).

By far the largest sand-dune area in the Western Hemisphere, the Sand Hills region of Nebraska is

more than 10 times larger than the State of Delaware and almost 3 times the size of Massachusetts. However, unlike other great sand-dune areas of the world, the Nebraska Sand Hills region is not a desert. Not only is its surface stabilized by a grass cover, but beneath it is a thick sequence of ermeable rocks filled to overflowing with water. Hundreds of shallow lakes are present, and many streams having remarkably steady rates of flow rise within the region. There exists a considerable potential for additional developments of natural resources. The Ogallala aquifer which forms the High Plains surface, underlies the entire Sand Hills. Currently, the long-term average rate of replenishment is virtually equalled by the long-term average rate of natural discharge. Large quantities of groundwater could be pumped from wells in parts of the Sand Hills region without appreciably diminishing the flow of streams or the amount of water in storage there. Water now being lost to evapotranspiration could be salvaged by pumping. (Knapp-USGS)
W71-08112

SELECTED WATER RESOURCE RECORDS FOR OKALOOSA COUNTY AND ADJACENT

Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 07C. W71-08114

LIMESTONE SOLUTION WITHIN THE EAST MENDIP AREA, SOMERSET, Saskatchewan Univ., Regina. Dept. of Geography.

Cave Research Group of Great Britain Transactions, Vol 12, No 4, p 259-270, Dec 1970. 12 p, 8 fig, 2 tab, 22 ref.

Descriptors: *Underground streams, *Karst, *Limestones, *Dissolved solids, *Water chemistry, Chemical analysis, Caves, Springs, Water temperature, Flow rates, Surface waters, Hydrologic data, Data collections, Groundwater movement, Water quality, Streamflow. Identifiers: *Sinking streams, *England, Stream-

flow characteristics.

Measurements of calcium and magnesium carbonate content, pH, saturated pH, temperature and discharge were made at a group of three major re-surgences and their associated underground streams on the north flank of Beacon Hill, eastern Mendip, England, over a three-year period. Considerable variations in calcium carbonate content were found between individual sinking streams and between risings. These differences were reflected in temperature and Langelier Index differences. The effects of mixture corrosion and differential supply of carbon dioxide to the water are postulated as possible factors causing these variations.
(Woodard-USGS)
W71-08116

AN ELEMENTARY STUDY OF THE CAVE MORPHOLOGY AND SEEPAGE IN THE REYFAD/POLLNACROM SYSTEM, NORTHERN IRELAND, R. A. Halliwell.

Cave Research Group of Great Britain Transactions, Vol 12, No 4, p 271-281, Dec 1970. 11 p, 3 fig, 3 tab, 16 ref.

Descriptors: *Karst, *Caves, *Rainfall disposition, *Scepage, *Groundwater movement, Gravitational water, Flow rates, On-site investigations, Data collections, Water yield, Analytical techniques, Statistical methods, Rainfall. Identifiers: *Northern Ireland, *Cave morphology.

Data were collected on cave seepage in County Fermanagh, Northern Ireland, July 1969. The work was done in two parts, a study of the cave morphology and a study of the hydrology. The latter concentrated on the precipitation and its relation to the seepage rates measured in the cave.

The sampling points were locations at which water was dripping from the roof. The method of location of drip points was to stand still, listen, and then move towards the sound of the dripping. It was possible to locate a single drip point, identify it, and mark it with fluorescent paper quite speedily. The number of drips which fell in a five minute period was counted. Correlation coefficients between the drip rate values and the rainfall were calculated. The paper is intended to show how information to the caver can be produced from very elementary data collection by simple statistical analysis. (Woodard-USGS) W71-08117

PRELIMINARY RESULTS OF AN APPLICATION OF THE PROCEDURE FOR THE MEASUREMENT OF AGGRESSIVENESS OF WATER TO CALCIUM CARBONATE,

Cave Research Group of Great Britain Transactions, Vol 12, No 4, p 283-289, Dec 1970. 7 p, 6 fig, 12 ref.

Descriptors: *Underground water, *Caves, *Limestones, *Water analysis, *Water chemistry, Chemical analysis, Analytical techniques, Hydrogeology, Geology, Rainfall, Temperature, Percolation, Percolating water, Hydrographs, Groundwater movement, Temporal distribution, Surface waters, Karst.

Identifiers: *England, *Cave hydrology, Sinking

The usefulness of a procedure for the measurement of aggressiveness of water to calcium carbonate was investigated by incorporating it in a more comprehensive hydrological study in G. B. Cave, Somerset, England. In a study of the solution of limestone by the main stream, the important part played by boulder ruckles was shown. Temporal changes in potential total hardness were investigated in streams of underground water and percolation water; effects of precipitation and temperature were found to be negligible except in times of highly abnormal rainstorms, in which case delayed effects were found. Variations in aggresjunction with hydrographs, giving new information concerning the mechanism of limestone solution in the Mendip Hills of Somerset. (Woodard-USGS) W71-08118

2G. Water in Soils

PEDOLOGIC FEATURES OF RESERVOIR SEDIMENTATION,

Purdue Univ., Lafayette, Ind. Water Resources Research Center.

For primary bibliographic entry see Field 02H. W71-07702

SOME TECHNIQUES FOR THE MEASURE-MENT OF PLANT AND SOIL WATER POTEN-TIALS WITH THERMOCOUPLE PSYCHROME-

Montana State Univ., Bozeman. Water Resources Research Center.

For primary bibliographic entry see Field 02I. W71-07836

THE GEOCHEMISTRY OF SODA SOILS.

N. I. Bazilevich.

Available from the National Technical Information Service as TT-6955086, \$3.00 in paper copy, \$0.95 in microfiche, Jerusalem, Israel Program for Scientific Translations, 1970. 392 p. Trans. of Geokhimiya Pochv Sodovobo Zasoleniya, Moscow,

Identifiers: *Soda ash deposits, *Geochemistry, *Sodium carbonates, Geochemistry, *Soil chemistry, Soda ash deposits, *USSR, Soda ash deposits, Siberia, Salinity, Soil analysis, Groundwater, Trees, Plants, Surface water, Translations.

Field 02-WATER CYCLE

Group 2G—Water in Soils

This monograph embodies an attempt at an analysis and synthesis of multifarious natural processes (geological, geomorphological, climatic, formation of subsurface and surface waters, interaction between plants and soils), along with their evaluation for man's practical activities. The plans for amelioration and development of new lands in the USSR call for a full and correct understanding of the nature of soil-geochemical processes. This monograph successfully combines a profound understanding of landscape genesis and geochemistry from a detailed elucidation of soil processes, effect of the plant cover on turnover of substances in soils, with the basic principles of practical recommendations for the cultivation of soda soils.

W71-07840

NATURAL LEACHING OF THE HIGHLY SALT AFFECTED SOILS OF WESTERN RAJASTHAN, Public Health Engineering Lab., Jodhpur (India); Indian Grassland and Fodder Research Inst., Jhansi (India); and Central Arid Zone Research Inst., Jodhpur (India). I. C. Gupta, and C. T. Abichandani.

Journal of Soil and Water Conservation in India, Vol 18, Nos 1 and 2, p 62-64, Jan-June 1970. 3 p, 4

Descriptors: *Saline soils, *Leaching, *Irrigation practices, Soil conservation, Soil management, Irrigation, Cultivation. Identifiers: *India.

Saline groundwaters of salinity level 4 to 10 mmhos EC/cm occur widely in Western Rajasthan, India. Some of these are used for growing salt tolerant Kharchi wheat. Two rainy seasons of 250-400 mm rainfall serve to reclaim the soil, and no crop is taken during the rainy seasons because of capillary rise during the following hot season after the saline water irrigation is over. The highly saline sandy soil profile of medium depth became salt free with precipitation of about 10 cm in the cropping season of 1964-65 and supplemental irrigation with moderate saline water did not make the soils saline; there was no accumulation of soluble or exchangeable sodium in the root zone of the soil. (Knapp-USGS) W71-08071

EROSION OF UTTAR PRADESH SOILS BY WATER AND ITS RELATION TO SOIL PRO-

Allahabad Univ. (India). Dept. of Chemistry. For primary bibliographic entry see Field 02J.

NUMERICAL ANALYSIS OF FINITE DEPTH PROBLEMS IN SOIL-WATER HYDROLOGY, New South Wales Univ., Kensington (Australia).

School of Civil Engineering.

Nordic Hydrology, Vol 2, No 1, p 1-22, 1971. 22 p, 14 fig. 10 ref.

Descriptors: *Unsaturated flow, *Infiltration, *Soil water movement, *Percolation, *Numerical analysis, Mathematical models, Water table, Recharge, Pit recharge, Water spreading, Sands, Porous

Identifiers: Soil water hydrology.

The types of initial and boundary conditions which may be involved in the flow of water through an unsaturated profile to a water table are discussed. A numerical solution of the flow equation is outlined for use in calculating the one-dimensional drainage of a homogeneous profile and of ponded infiltration. Numerical solutions are given for the drainage of a stratified profile and infiltration into a draining profile. (Knapp-USGS) W71-08083

THE EFFECT OF HYDROPHOBIC SUB-STANCES ON WATER MOVEMENT IN SOIL

DURING INFILTRATION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station. Leonard F. DeBano.

Soil Science Society of America Proceedings, Vol 35, No 2, p 340-343, Mar-Apr 1971. 4 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Soil water movement, *Wettability, *Unsaturated flow, *Diffusion, *Infiltration, Permeability, Soil physical properties, Wetting, Diffusivity, Organic acids, Humic acids. Identifiers: Water-repellent soils.

The effect of hydrophobic substances on soil water movement was studied by infiltrating water horizontally and vertically into soil columns packed with wettable and water repellent soils. Horizontal with wettable and water repellent soils. Horizontal infiltration was 25 times slower in water repellent soil than wettable soil. In the water repellent soil, the water content decreased 20 to 25% between the water source and the wetting front. In contrast, water content dropped 10% in the same region of the wettable soil. Diffusivities calculated for the two types of soil suggested that hydrophobic substances had the greatest effect on water movement at the lower water contents. The orientation of the at the lower water contents. The orientation of the columns during water entry affected the shape of the soil-water profiles in the water repellent soil, but not in the wettable soil. The diffusivities calcu-lated from horizontal infiltration experiments were not useful for predicting soil-water profiles during vertical infiltration into either the wettable or water repellent soils. (Knapp-USGS) W71-08087

SOIL WETTABILITY IN UTAH JUNIPER STANDS.

Forest Service, Tempe, Ariz. David G. Scholl.

Soil Science Society of America Proceedings, Vol 35, No 2, p 344-345, Mar-Apr 1971. 2 p, 1 fig, 1 tab, 11 ref.

Descriptors: *Soil water movement, *Wettability, *Unsaturated flow, *Diffusion, *Infiltration, Permeability, Soil physical properties, Wetting, Diffusivity, Organic acids, Humic acids. Identifiers: Water-repellent soils.

Wettability varied widely between three groundcover zones and three soil horizons in a Utah juniper stand. Resistance to wetting in the surface soil increased from completely wettable in open areas to highly nonwettable in the litter under the juniper canopy. Resistance to wetting decreased with depth in the soil profile below the litter zone and increased with increasing organic matter. Changes in the soil moisture level also influenced the wettability of the various zones and horizons.
Wettability was determined at 1/3 and 15 bars moisture tension and air-dry, with the 15-bar level showing the greatest resistance to wetting. (Knapp-USGS) W71-08088

THE SOIL WATER REGIME OF AN ARID GRASSLAND COMMUNITY IN CENTRAL AUS-TRALIA,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Rangelands search Unit.

R. E. Winkworth. Agricultural Meteorology, Vol 7, No 5, p 387-399, Oct 1970. 4 fig, 14 ref.

Descriptors: *Arid lands, Soil water, Measurement, *Precipitation (Atmospheric), Evaporation, Percolation, Soil moisture, Equipment, Runoff, Foreign countries, Drying, Climatological data, Identifiers: *Australia, *Grassland.

A red-earth-soil arid tussock grassland in Australia was studied for precipitation recorded and soil moisture content over a two-year period. The climate is arid, with mild winters, and hot summers. Most precipitation occurs during the summers, with long dry periods separating times of rainfall. After rain, soil wetting was rapid down to about 35 cm. Depletion of soil moisture began about two weeks after precipitation, and soil moisture. weeks after precipitation, and soil moisture remained low until the next rainfall. Periods of remained low until the next rainfall. Periods of available soil water ranged from 25 to 141 days. Surface runoff always accompanied precipitation. Soil water storage was measured by gypsum-block conductivity. Results were affected by errors in wet soil and insensitivity of drying soil. 632 mm of precipitation were recorded during the study of which about 52 percent recharged the soil and 20 percent was directly evaporated. (Yensen-Arizona) W71-08142 W71-08142

RECLAMATION OF SALINE-SODIC SOILS IN THE UPPER COLORADO RIVER BASIN, Colorado State Univ., Experiment Station, Grand

Junction.

For primary bibliographic entry see Field 03C. W71-08146

2H. Lakes

PEDOLOGIC FEATURES OF RESERVOIR SEDIMENTATION,

Purdue Univ., Lafayette, Ind. Water Resources

Research Center.
Helmut Kohnke, Manuel Paulet, and L. J. Lund.
Available from the National Technical Information
Service as PB-198 806, \$3.00 in paper copy, \$0.95
in microfiche. Indiana Water Resources Research
Center Technical Report No 18, Apr 1971. 41 p, 7
fig, 3 tab, 39 ref. OWRR Project B-0113-IND (1).

Descriptors: *Sedimentation, *Reservoir silting, *Sedimentation rates, Sediment transport, *Sediment distribution, Bottom sediments, Clays, Parti-cle shape, *Particle size, Sands, Silts, Watersheds, Mineralogy, Petrology.

The purpose of the research was to determine quantitatively the extent soil characteristics of the contributing watershed influenced the rate and type of sedimentation in a reservoir. The study was made on fourteen reservoir - watershed combina-tions in Indiana and Illinois. Particle size charac-teristics of soils and sediments were shown to be most significant in relating watershed charac-teristics to reservoir sediment properties and sedi-ment rates. Under the conditions of the study, the finer the texture of the soils of the watershed and the more uniform their particle size, the greater were the sedimentation rates. Particle size analysis of the sediments was also helpful in distinguishing recent sediments from original bottom materials in the reservoir. The amounts of mica, vermiculite, the reservoir. The amounts of mica, vermiculite, kaolinite and amorphous alumina found in the clay fraction of sediments related well to that found in the contributing soils. Very little quartz was found in the sediment, it apparently being lost in transporting. No consistent variation was found between the clay mineralogy of the sediments and position within a reservoir. The clay mineralogy of the soils in the watersheds could not be identified as having a direct offset on the sedimentation rates of the a direct effect on the sedimentation rates of the reservoirs. (Wiersma-Purdue) W71-07702

EFFECTS ON LAKE PONTCHARTRAIN, LA., OF HURRICANE SURGE CONTROL STRUCTURES AND MISSISSIPPI RIVER-GULF OUTLET CHANNEL, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. For primary bibliographic entry see Field 08B. W71-07791

INSTRUMENTATION FOR MEASURING PHYSICAL PROPERTIES OF A LAKE, Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

Ditmar H. Bock.

IEEE Transactions on Geoscience Electronics, Vol GE-8, No 1, p 46-59, 1970. 16 fig, 8 ref.

Descriptors: *Thermal water, *Temperature, *Flow rates, Instrumentation, Measurement, Powerplants, Nuclear powerplants, Data transmissions, Telemetry, Currents (Water), New York. Identifiers: *Cayuga Lake (NY), Digital-to-analog

This device for recording temperature profiles and flow rate of water was developed and installed at several points in Cayuga Lake, (NY), in connection with the projected construction of a nuclear-fueled power plant. The recording instruments, mounted on buoys, are connected to shore by means of coaxial cable which transmits by audio tones frequency the variables being recorded. Time division multiplex is used for sampling signals. At division multiplex is used for sampling signals. At the shore the data are recorded in digital or analog format. The output of a digital-to-analog converter deflects a paper chart recorder for monitoring purposes. Connection of the signals to a Bell Telephone voice quality line permits a remote access to the data. (Wilde-Wisconsin) W71-07882

ON RESEARCH OF HUMIC SUBSTANCES IN ESTONIAN LAKES (IN GERMAN),

Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.

For primary bibliographic entry see Field 05C. W71-07883

NUTRIENT SUPPLY AND PRIMARY PRODUCTION IN CLEAR LAKE, EASTERN ONTARIO,

Trent Univ., Peterborough (Ontario) For primary bibliographic entry see Field 05B. W71-07890

URANIUM-234 AND URANIUM-238 IN THE WATERS AND BOTTOM SEDIMENTS OF LAKE BALKHASH AND THE AGE OF THE LAKE,

Akademiya Nauk Kirghiz SSR, Frunze. Inst of Physics and Mathematics.

P. I. Chalov, N. A. Suctlichnaya, and T. V. Tuzova. Translated from Geokhimiya, No 7, 1970. Geochemistry International, Vol 7, No 4, p 604-610, 1970. 7 p, 6 tab, 25 ref.

Descriptors: *Radioactive dating, *Lakes, *Bottom sediments, Salts, Uranium radioisotopes, Geochemistry, Radioactivity techniques, Stratig-raphy, Water chemistry. Identifiers: Lake Balkhas (USSR).

The U-234: U-238 composition of the bottom sediments and water of Lake Balkhash, USSR, was investigated by alpha-particle spectrometry. The age of the lake (37 plus or minus 7 thousand years) determined from radioactive disequilibrium agrees with geological evidence. These ages are substantially different from the ages calculated from the rate of accumulation of salts. Calculation of the age of lakes without outlets from the rate of accumulation of salts gives results conflicting with geological observations not only for Lake Balkhash but also for the Sea of Aral. (Knapp-USGS)

FORMATION CONDITIONS OF SULPHUR-BEARING MUDS IN CURRENT CRATER LAKES.

State Inst. for Mined Chemical Raw Material, Lyubertsy, (USSR); and Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.

A. Yu. Lein, V. A. Grinenko, and M. V. Ivanov. Translated from Geokhimiya, No 8, 1970. Geochemistry International, Vol 7, No 4, p 664-672, 1970. 9 p, 6 fig, 5 tab, 16 ref.

Descriptors: *Water chemistry, *Craters, *Lakes, *Volcanoes, *Sulfur, Sulfur compounds, Sedimen-

tation, Chemical precipitation, Mineralogy, Geochemistry, Gases, Bottom sediments. Identifiers: *USSR.

Chemical sedimentation is the principal process producing sulfur-bearing muds in acid crater lakes: it produces thin-bedded sediments consisting of native sulfur (25-55%), opal, alunite, and clay minerals. Iron sulfides are produced at the mudwater interface or by diagenesis of the muds. The S-34 content of the native sulfur and sulfides lie within the limits characteristic of volcanic H2S. Three main factors control sedimentation in new crater lakes: (1) rapid influx of sulfur-bearing gases from bottom fumaroles, (2) high corrosiveness of the very acid water, (3) influx of clastic and pyroclastic material. The rates of accumulation of sulfur in crater lakes are greater than those under the conditions of ordinary sedimentation by factrs greater than 100. For instance, the sulfur muds of Lake Goryacheye (Ebeko volcano), USSR, produce about 48 kg of sulfur per cum' in a year. (Knapp-USGS) W71-07945

ON BIOLOGICAL NITROGEN FIXATION IN NATURE, PARTICULARLY IN BLUE-GREEN

Carlsberg Laboratoriet, Copenhagen (Denmark).
Carsten Olsen.

Comptes Rendus des Travaux du Laboratoire Carlsberg, Vol 37, No 12, p 269-283, 1970. 6 tab, 19

Descriptors: *Nitrogen fixing bacteria, *Nitrogen fixation, *Cyanophyta, Nitrogen, Hydrogen ion concentration, Iron, Swamps, Manganese, Water quality control, Ions, Anaerobic conditions, Mud, Sands, Calcium, Symbiosis, Molybdenum, Cobalt, Lakes, Boron, Sodium, Potassium, Phosphates, Submerged plants, Legumes, Oceans, Laboratory tests.

Identifiers: Azolla, Anabaena, Azolla caroliniana, Denmark, Azolla filicoides, Zinc, Azolla pinnata, Lemna, Ferric ions, Azolla nilotica, Trichodesmium thiebautii, Sargasso Sea, Caribbean Sea.

When Azolla caroliniana, which lives in symbiosis with the blue-green alga, Anabaena azolla, is transplanted into certain types of small Danish lakes, it can spread forming a thick blanket covering the entire water surface, and can fix up to 95 kg of nitrogen per hectare in one summer. Azolla caroliniana only thrives in small lakes and other water areas where the water is usually more or less brownish, has a pH value around 6 to 7, and contains ferrous ions or complex iron-humus compounds and manganous ions in suitable concentrations. Molybdenum and cobalt are also necessary, although in very small quantities, for Azolla to attain maximum rate of fixation. The presence of ferrous ions is due to anaerobic processes in the mud layer whereby ferrous sulfide is formed. In lakes with sandy bottoms without mud and with clear, colourless water with pH values from 7 to 8 and a large calcium content (about 50 mg/l), iron occurs only as ferric ions, and in such lakes, Azolla will not develop. The plants grow chlorotic and gradually perish due to iron deficiency. Four species of Azolla are mentioned with world distribution. (Jones-Wisconsin)

MICROFLORA OF CHLORELLA K DURING A PROLONGED CULTIVATION OF THE ALGAE IN A PERFUSION UNIT WITH A CONTINUAL RECYCLING OF THE CULTURE MEDIUM, (IN RUSSIAN).

Moscow State Univ. (USSR). Faculty of Biology

For primary bibliographic entry see Field 05C. W71-08027

W71-08024

FOOD NICHE AND CO-EXISTENCE IN LAKE-DWELLING TRICLADS,

North Wales Univ. College, Bangor (United Kingdom). Dept. of Zoology; and University Coll. of North Wales, Bangor. Dept. of Zoology. For primary bibliographic entry see Field 05C. W71-08033

CENTRARCHID FOOD HABITS IN A NEW AND OLD RESERVOIR DURING AND FOLLOWING BASS SPAWNING,

Bureau of Sport Fisheries and Wildlife, Fayet-

James W. Mullan, and Richard L. Applegate.
Proceedings of the 21st Annual Conference of the Southern Association of Game and Fish Commissioners, p 332-342, 1967. 5 fig, 2 tab, 11 ref.

Descriptors: *Spawning, *Fish, *Reservoirs, Fish diets, Food habits, Predation, Bass, Populations, Sunfishes.

Identifiers: *Centrarchidae, Bull Shoals Reservoir (Ark-Mo), Beaver Reservoir (Ark-Mo), New impoundments, Old impoundments, Sunfish, Bluegill.

Examinations were made of the stomach's contents of sunfish, bluegill, and largemouth, smallmouth, and spotted bass inhabiting a 15-year old reservoir and a reservoir in the process of filling. The study was conducted during and following bass spawning. The results suggested that the new basin contained an adequate supply of food to sustain the cen-trarchid population. The opposite was true of the old reservoir; its large fish consumed the ten-dipedids and cladocerans, as well as some eggs and young of bass. The newly hatched largemouth bass were dependent on left-overs of small prey. (Wilde-W71-08035

THE COPEPODA AND CLADOCERA OF A MISSOURI RIVER RESERVOIR: A COMPARISON OF SAMPLING IN THE RESERVOIR AND THE DISCHARGE,

Bureau of Sport Fisheries and Wildlife, Yankton,

For primary bibliographic entry see Field 05C. W71-08036

THE 1963-64 LAKE MEAD SURVEY,

Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.

For primary bibliographic entry see Field 04A.

CONCENTRATIONS OF POLLUTANTS IN AGRICULTURAL RUNOFF, Texas Tech. Univ., Lubbock. Dept. of Civil En-

gineering; and Texas Tech. Univ., Lubbock. Dept. of Chemistry.
For primary bibliographic entry see Field 05B.

W71-08053

EVALUATION OF THE WATER BALANCE OF AN INTERCONNECTED GROUP OF LAKES AS ILLUSTRATED BY THE GREAT MASURIAN LAKES.

State Inst. of Hydrology and Meteorology, Warsaw (Poland).

Zdzislaw Mikulski. Geographia Polonica, No 14, p 165-173, 1968. 9 p,

3 fig. 1 tab.

Descriptors: *Water balance, *Lakes, Storage capacity, Precipitation (Atmospheric), Evapora-tion, Runoff, Water storage, Inflow, Discharge (Water), Hydrologic data. Identifiers: *Poland, Great Masurian Lakes, Lake storage, Water exchange, Water divide.

An attempt is made to work out the water balance of a group of interconnected lakes forming one hydrographic system. The Great Masurian Lakes located in the region of the Masurian Lake District

Group 2H—Lakes

of northwest Poland are used as an example. Lakes of the Great Masurian Lake group located in the vicinity of the water divide show a relatively low water exchange, while the small transit lakes lying some distance from the divide have an intense water exchange. The range of fluctuations for the small lakes is vast--from several percent to well over three hundred. The annual water exchange in the northern part of the lake group amounts to 110 million cu m, so that with a lake storage capacity of over 1,000 million cu m the exchange rate is about 10%. The southern part of the lake group carries off almost five times more water than the northern part so that, with a storage capacity of approximately 1,600 million cu m, nearly one third of the water is exchanged in the course of a year. The en-tire group of Great Masurian Lakes exchanges an-nually about 40% of its waters, so that full exchange of waters theoretically takes place within exchange of waters theoretically takes place within about 2 1/2 years. A water layer of approximately 2.60 m thickness per year undergoes exchange. A tentative assessment of the water balance presented may provide an approach to developing water balance methods for interconnected lake groups. (Josefson-USGS) W71-08111

A PROSPECT OF LAKE KARIBA, University Coll. of Rhodesia, Salisbury. Alan Bowmaker.

Optima, Vol 20, No 2, p 68-74, June 1970. 7 fig, 1

Descriptors: Limnology, *Ecology, *Productivity, *Biological communities, *Vegetation effects, Thermocline, Thermal stratification, Epilimnion, Hypolimnion, Environmental effects, Life cycles, Aquatic populations, Physicochemical properties, Littoral, Fish diet, Fish establishment, Fish populations, Water level fluctuations, Water hyacinth, Nutrients, Tropical regions, Habitats, Ecosystems. Identifiers: *Lake Kariba, *Rodesia, *Plant pests, *Littoral hydrophytes.

When first created, Lake Kariba, in Rhodesia was the largest man-made lake in the world. The lake attracted a massive and famous international effort to rescue wildlife trapped by the rising waters. This effort was largely meaningless because no suitable alternative habitat was available for large mammals. Before it's creation, only cursory ecological studies were made, and this shortsight, together with a generally low level of knowledge concerning phenomena associated with the creation of lakes in tropical regions, have been reflected in the development of unforeseen problems and many errors in productivity predictions. However, unforeseen benefits have also occurred. The unseasonal flooding effects down river, caused by the lake, have endangered a considerable amount of crucial wildlife habitat. In the lake itself, thermal stratification has developed, resulting in a gradual increase in colonization space but decreases in productivity and nutrient levels after a large initial increase. Evidence indicates that nutrient levels may soon gradually increase again. A massive mat of Salvinia developed on the surface, giving rise to much anxiety and many studies on its control. Water level fluctuations have had a critical effect on productivity, since they have kept littoral hydrophytes very low and disturbed the young of some fish populations. The author feels that Salvinia may actually be beneficial since annual changes in lake volume are as much as one-third, and this would have lead to great nutrient losses if they had not been locked up in Salvinia. Introduction of Tilapia macrochir seems to have been ill-conceived, but several important species not present in the pre-impoundment era have appeared. Future projects will require much more understanding between the biologist and engineer. (Casey-Arizona) W71-08141

FERN LAKE MINERAL METABOLISM PRO-GRAM,

Washington Univ., Seattle. Coll. of Fisheries. Lauren R. Donaldson.

Available from the National Technical Information Service as RLO 2225-T-7-3, \$3.00 in paper copy, \$0.95 in microfiche. Annual Progress Report, June 16, 1970.

Descriptors: *Lakes, *Food chains, *Fishes, Algae,

Identifiers: Mineral metabolism, *Fresh water biology, Ecology, Plankton, Fern Lake.

This past year the studies at Fern Lake have produced challenging and, in some cases, contrasting results with previous years. Fertilization was instituted in the contract of itiated in mid-June and was continued at weekly in-tervals for a ten-week period. The slow response of ttervals for a ten-week period. The slow response of the primary producers was significant and the later dominance of a blue-green alga, Anabaena sp., had consequences that resulted in some undesirable effects, particularly to the zooplankton. Insect emergence responded favorably to the enrichment, especially in the spring of 1970, when emergence records for the ooze area were the highest ever recorded for the lake. The rainbow-steelhead trout hybrids planted in the lake this year, although showing abnormally poor growth during the fall and winter because of the low zooplankton population, produced phenomenal growth as the spring midge emerged. The growth data were almost twice that of any other year. The maximum size of the trout was 270 g, compared to previous highs of 100 g. In May of 1970, sockeye salmon were planted in the lake. This species is a plankton-feeder and will provide an opportunity to compare the production provide an opportunity to compare the production and behavioral characteristics of this fish with those of the steelhead trout. W71-08175

A STOCHASTIC APPROACH TO THE DEVELOPMENT OF A REGULATION PLAN FOR THE GREAT LAKES, Department of Energy, Mines and Resources, Ottawa (Ontario); and McGill Univ., Montrel

(Quebec).

For primary bibliographic entry see Field 06B. W71-08267

TEMPERATURE VARIATIONS IN A WATER RESERVOIR,

A. G. Kolesnikov

A. G. Kolesnikov. Trans. from Doklady Akademii Nauk SSSR, Vol. 92, No 1, 1953. Available from the National Technical Information Service as AD-715 028, \$3.00 paper copy, \$0.95 microfiche. Cold regions Research and Engineering Lab., Hanover, N.H. Translation, 1970. 7 p.

Descriptors: *Ice, *Reservoirs, *Winter, *Heat transfer, *Mathematical models, Heat budget. Identifiers: *Ice cover, *Temperature variations, *Ground heat reserves, Temperature distribution.

The heat regime of reservoirs is usually reported on the basis of summer season investigations and there are virtually no studies of the winter heat regime of waters. The author proposes a solution to the problem of the formation of the temperature variations of water in a reservoir in the winter season during ice cover conditions. The derived equation consists of three terms. The first characterizes the stationary distribution of temperatures; the second term reflects the changes caused by the deviation of the initial distribution of water temperature at the time of formation of a continuous ice cover from a stationary value. The third term is of the greatest interest. It shows how the water tempera-ture increases under the ice with its heating by the heat reserves contained in the ground. (Olesz-kinvier Vendeshild) kiewicz-Vanderbilt) W71-08320

2I. Water in Plants

EFFECT OF WATER AVAILABILITY ON PHOTOSYNTHESIS OF PLANTS,

Illinois Univ., Urbana. Water Resources Center. For primary bibliographic entry see Field 03F.

CARBON DIOXIDE AND WATER VAPOUR **EXCHANGE IN ATRIPLEX LEAVES,**

Australian National Univ., Canberra. Research School of Biological Sciences. For primary bibliographic entry see Field 02D. W71-07808

STOMATA AND CUTICULAR SURFACES ON PINUS RADIATA NEEDLES AS SEEN WITH A SCANNING ELECTRON MICROSCOPE,

Duke Univ., Durham, N.C. D. A. Rook, H. Hellmers, and J. D. Hesketh.

NSF Grant GB-7153. Journal of the Arizona

Academy of Sciences, Vol 6, No 3, p 222-225, Feb

1971. 7 fig, 5 ref.

Descriptors: *Electron microscopy, *Pine trees, *Leaves, *Stomata, *Cuticles, Moisture stress, Temperature, Plant morphology, Laboratory tests, Laboratory equipment. Identifiers: *Monterey Pine, *Wax cuticles.

Since no drastic prestudy treatment is necessary, plant anatomy studies with the scanning electron plant anatomy studies with the scanning electron microscope have the advantage of relatively fresh plant material. Two groups of Pinus radiata seedlings were examined. One group was grown from New Zealand breeding program seed and the other from seed of a native California stand. The New Zealand seedlings were grown under differing moisture regimes, being watered either daily or once every 2 weeks. The California seedlings were subjected to differing temperature regimes some subjected to differing temperature regimes, some of which were near the hot and cold limits of of which were near the hot and cold limits of growth. Primary and secondary needles were then examined with the scanning electron microscope for differences in stomatal and waxy cuticular morphology. The secondary needle surfaces are ridged with numerous tubular outgrowths from stomata arising from a relatively smooth wax layer. By contrast, the cuticular surfaces of the primary needles and cotyledons were covered with wax flakes. No differences were observed in surface topography between drought conditions or growing temperature in any of the groups. (Casey-Arizona) W71-07811

ANIMAL UTILIZATION, Khartoum Univ. (Sudan). Dept. of Zoology; and Sudan Natural History Museum, Khartoum (Sudan).

J. L. Cloudsley-Thompson. In: Arid Lands In Transition, p 57-72, Pub No 90, AAAS, 1970. 7 fig, 24 ref.

Descriptors: *Arid lands, *Xerophilic animals, *Grazing, *Herbivores, *Social aspects, Animal behavior, Water users, Dams, Ecology, Water balance, Water shortage, Goats, Cattle, Food habits, Ecosystems, Land uses, Deferred costs, Water quality, Productivity, Human populations, Political aspects, Irrigation effects.

Identifiers: *Sahara Desert, *Nomads, *Developing nations *Camels *Ostriches

ing nations, *Camels, *Ostriches.

The major resource of desert areas is an inexhausti-ble supply of solar energy. While many desert re-gions may be made to bloom with water applications, the major water supply, groundwater, is extremely variable in quality and prospects for its utilization in most desert regions are far from encouraging. The potentialities of animal science in areas, particularly the Sahara Desert, where water is unavailable for irrigation, are reviewed. Man's effects on the deserts have been primarily destructive, particularly through overgrazing, so that deserts of low productivity have expanded into larger deserts of virtually zero productivity. In the Sahara, goats increase productivity, but contribute further to ecological degradation. Increasing water-hole distribution should increase herbivore grazing ranges, but this is of limited practicality. The current policies of various governments leading to per-manent settlement of nomads is probably ill-conceived, since in many areas, nomadism is the only possible form of desert exploitation. Desert irrigation projects lead to critical medical entomological problems such as malaria, trachoma, amoebic

dysentary and bilharziasis. They also encourage desert locusts, which may be self-defeating in terms of expanding crop production. Possible grazing species which may enhance animal production are considered, and the major possibilities appear to be the camel and the ostrich. Human food habits presently seem to preclude the camel. Inadequate familiarity with desert ecology is resulting in a number of questionable development schemes that are serving only to expand the desert. Additionally, more account must be taken of cultural peculiarities, which may also serve to defeat many projects. (Casey-Arizona) W71-07815

ONION SEED PRODUCTION IN YUMA COUN-

Agricultural Research Service, Tucson, Ariz. For primary bibliographic entry see Field 03F.

WHEAT IRRIGATION AFFECTS FLOUR

YIELD AND QUALITY,
Arizona Univ., Tucson; and Arizona Agricultural
Experiment Station, Tucson. For primary bibliographic entry see Field 03F.

W71-07819

LOCALIZATION OF IONS IN THE MESOPHYLL CELLS OF THE SUCCULENT HALOPHYTE SUAEDA MONOICA FORSSK. BY X-RAY MICROANALYSIS,

Tel Aviv Univ. (Israel). Dept. of Botany Y. Waisel, and A. Eshel.

Experientia, Vol 27, No 2, p 230-232, 1971. 2 fig,

Descriptors: *Halophytes, Ions, *X-ray analysis, *Salt balance, *Plant physiology, Laboratory tests, Sodium, Potassium, Chlorides, Phospho Leaves, Sodium chloride. Identifiers: *Vacuoles, *Cytoplasm, Seepweed. Chlorides, Phosphorus,

Seeds of Suaeda monoica, a halophyte, were grown in water culture on a half-strength Hoagland's solu-tion. Fifty mM NaCl were added to half the plants and 4 weeks later cotyledons and leaves were taken and 4 weeks later cotyledons and leaves were taken for analysis. Na, K, p and Cl were determined by X-ray micronalysis. In NaCl-treated plants, most of the Na and located within the cytoplasm, with very little located within the vacuoles. Cl levels were low but evenly distributed. Vacuolar P was negligible. In Na-deficient plants (grown under non-saline conditions), K was distributed throughout the cells, but occurred in greater quantity in the vacuoles. It seems to substitute for Na. P occurred in both cytoplasm and vacuoles. Although the experimental method does not yet permit exact quantitative data evaluation, the resolution obtained still permitted a gross distinction between 2 major cell compartments. It is concluded, that, contrary to current theories concerning halophyte salt tolerance, the mesophyll cells of Suaeda absorb and retain high quantities of Na in the cytoplasm rather than reject it. Probably the Na is utilized in critical cytoplasmic growth mechanisms. (Casey-Arizona) W71-07820

THE EFFECT OF WATER POTENTIAL ON THE CARBON DIOXIDE COMPENSATION POINT OF MAIZE AND SUNFLOWER LEAF

TISSUE,
Tel Aviv Univ. (Israel). Dept. of Botany.
Z. Glinka, and M. Y. Katchansky.
Israel Journal of Botany, Vol 19, No 4, p 535-541, 1970. 4 fig, 3 tab, 18 ref.

*Carbon dioxide. Descriptors: Photosynthesis, *Dehydration, *Hydrostatic presure, Modes of action, Osmotic pressure, Stomata, Plant physiology, Laboratory tests, Turgidity. Identifiers: *Carbon dioxide compensation point, *Water potential, *Relative water content.

carbon dioxide compensation point, established at constant light and temperature values, expresses the state of balance between absorbing and releasing carbon dioxide processes in a leaf system under given conditions. Its experimental significance is in the elimination of the stomatal resistance factor. Sunflower and maize leaf segments were saturated in water, partially dried, and relative water content (RWC) was determined by weighing Tissue water potentials and osmotic potentials were determined under varying conditions. The carbon dioxide compensation points were measured, in air, by an infrared gas analyzer. With RWC decreasing to 73%, leaf compensation points gradually increased to about 300 microliters per liter. After rehydration, compensation points dropped to within range of their initial levels. The compensation point of a non-uniformly dehydrated tissue is affected mainly by its less dehydrated areas. The water potentials and osmotic potentials of both species were plotted vs. RWC on the same graph. The paired osmotic and water potential curves for each species intersected at the point of zero turgor pressure, indicating the development of small negative wall pressures at lower RWC. When leaf potentials were lowered to the same extent in mannitol solutions, the compensation points obtained, for maize and sunflower, were only 15 microliters per liter and 110 microliters per liter. Apparently the drastic increase in compensation point is due neither to stomatal closure nor to decreased water potential per se. A plot of compensation point vs. turgor pressure clearly shows a steep rise in tissue turgor with the same rise in compensation point, suggesting that in cells dehydrated in air, developing negative hydrostatic forces are a decisive factor in affecting net photosynthesis rate. (Casey-Arizona) W71-07826

AGGREGATE SUPPLY RESPONSES FOR EASTERN COLORADO WHEAT FARMERS, Economic Research Service, Washington, D.C. Farm Production Economics Div.; and Colorado State Univ., Fort Collins. Dept. of Economics For primary bibliographic entry see Field 03F

SOME TECHNIQUES FOR THE MEASURE-MENT OF PLANT AND SOIL WATER POTEN-TIALS WITH THERMOCOUPLE PSYCHROME-TERS.

Montana State Univ., Bozeman. Water Resources Research Center.

Thomas J. Nimlos, Lee E. Eddleman, Charles

Seeley, and James M. Jones.

Available from the National Technical Information Service as PB-199 037, \$3.00 in paper copy, \$0.95 in microfiche. Montana Water Resources Research Center, Bozeman, Report No 14, Feb 1971. 25 p, 6 fig, 3 tab, 43 ref. OWRR Project A-039-MONT

W71-07827

Descriptors: *Water measurement, *Soil-waterplant relationships, Plants, *Plant growth. Identifiers: *Thermocouple psychrometers.

Studies of soil water-plant growth relationships have been hampered by the lack of an accurate, rapid method for the measurement of the tension (potential) water is under in the plant and in the soil. Recently a new method, called the thermocouple psychrometer technique has been developed whereby these measurements can be made. Thermocouple psychrometry is based on the assumption that the relative humidity near a leaf surface or in a soil mass reflects the water potential of that leaf or soil. The techniques involve measuring the relative humidity in or near a plant or soil system with ultrafine thermocouples which, by employing the Peltier effect, can be made to function as psychrometers. The measurement of soil moisture stress with the thermocouple psychrometer is very rapid and relatively easy. (Holje-Montana) W71-07836

THE GEOCHEMISTRY OF SODA SOILS, For primary bibliographic entry see Field 02G. W71-07840

A PROPOSAL OF CLASSIFICATION OF VEGETATION HABITATS ON THE BANKS OF CZECHOSLOVAK WATER COURSES FROM THE HYDROLOGICAL STANDPOINT, (IN GERMAN),

Ceskoslovenska Akademie Ved, Prague. Botanicky

For primary bibliographic entry see Field 02E. W71-07879

TREE GROWTH, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07943

0-18/0-16 RATIOS AND RELATED TEMPERA-TURES OF RECENT PTEROPOD SHELLS (CAVOLINIA LONGIROSTRIS LESUEUR) FROM THE PERSIAN GULF, Goettingen Univ. (West Germany). Geological-Paleontogical Inst.

For primary bibliographic entry see Field 02K. W71-08068

VARIATIONS IN CREOSOTEBUSH (LARREA

DIVERICATA) EPIDERMIS, Agricultural Research Service, Tucson, Ariz. Plant Science Research Div. and Arizona Agricultural Experiment Station, Tucson.

Herbert M. Hull, Samuel J. Shellhorn, and Richard

Journal of the Arizona Academy of Sciences, Vol 6, No 3, p 196-205, Feb 1971. 8 fig, 2 tab, 37 ref.

Descriptors: *Xerophytes, *Ecotypes, *Plant morphology, *Epidermis, *Cuticle, Resins, Leaves, Stomata, Herbicides, Shrubs, Habitats, Electron

microscopy, Absorption. Identifiers: *Creosotebush, *Chihuahuan Desert, *Guard cells, *Trichomes.

Creosotebush is probably the most common southeastern desert shrub, characterized by leathery, dense leaves with an unusually high weight/area ratio. It is extremely drought resistant and grows in a diversity of habitats. In many areas, it has invaded former grasslands, reducing their forage production and carrying capacity. Chemical control currently appears economically unfeasible because of the excessively high herbicidal rates required. Because epidermal and cuticular structure markedly affect herbicidal absorption, an attempt was made to determine whether these structures differ in plants from 3 widely differing Chihuahuan Desert habitats. Using light and electron microscopy techniques, the structures of cuticles, epidermis cells, guard cells and mesophyll cells were examined. Cuticle and cell wall thicknesses of both leaves and stems varied more among individuals of one location than between locations. Insignificant differences in cuticle thickness between adaxial and abaxial surfaces and in epidermal cell walls indicate that differences in herbicidal sensitivities between collection sites could not be ascribed to differences in epidermal or cuticular development. The thickness of the guard cells and their subsidiary cells indicate they are of little value in transpiration supression. The distinct trichome cuticularization suggests that this structure inhibits solute absorption following a foliar spray. Probable absorption occurs via the stomata or directly through the epidermal cuticle. Since there is an inverse correlation between resin content and elevation, it appears unlikely that resins filter out harmful UV radiation. (Casey-Arizona)

THE ECOLOGY OF SMALL MAMMALS AT SARATOGA SPRING, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA, Nevada Univ., Reno.

Field 02—WATER CYCLE

Group 21—Water in Plants

W. Glen Bradley, and James E. Deacon.
Partially supported by National Park Service Contract 14-10-0434-0989. Journal of the Arizona Academy of Sciences, Vol 6, No 3, p 206-215, Feb 1971. 6 fig, 4 tab, 8 ref.

Descriptors: *Mammals, *Xerophilic animals, *Ecology, *Arid lands, *Water holes, Xerophytes, California, Rodents, Mammal groupings, Wildlife, On-site investigations, Environmental effects, Surveys, Vegetation effects, Physiological ecology, Reproduction, Animal behavior, Biomass, Temperature, Precipitation, Edge effect, Ecosystems, Habitats, Springs. Identifiers: *Death Valley, *Mojave Desert, *Species compession.

cies compostion.

The Saratoga Springs area of Death Valley National Monument is a low elevation marshy area with a mosaic of diverse habitats. The percentage perennial plant covers of 6 habitats were measured and described. Temperature records during the study range from below freezing in winter to above 40°C in the summer. Bats were collected by shooting and mist netting, while rodents were collected in snap traps. The rodent trapping program was designed to compare relative abundance in creosote bush, rocky canyon, sand dune, salt flat and marsh habitats. Stomach and gonadal autopsies were performed to determine food habits and reproductive condition. Short accounts are given of each trapped rodent species, and their numbers relative abundance and biomass in each of the major habitats were tabulated. Excepting the salt flats, the total number of species trapped in the major habitats did not significantly differ, but numbers varied widely. Relative abundances were greatest in the more mesic sand dune and marsh habitats and could be correlated with availability of food (especially green plants), shelter and water. The edge effect created by the spatial relationships between the marsh and sand dunes probably also affects biomass. Young and subadults increase in numbers in the late spring, summer and fall, while winter populations are almost exclusively com-posed of adults. Stomach analyses indicate a high proportion of green vegetation in diets, and the length of most species' breeding seasons are probably proportional to it's availability. (Casey-Arizona) W71-08140

EVALUATIONS OF GRASSES, LEGUMES, AND GRASS LEGUME MIXTURES FOR IRRIGATED PASTURES GRAZED BY SHEEP UNDER VARI-FERTILITY AND MANAGEMENT PRAC-TICES,

Agricultural Research Service, Flagstaff, Ariz. Crops Research Div.

For primary bibliographic entry see Field 03F. W71-08147

PANHANDLE RESEARCH STATION PROGRESS REPORT - 1969, GOODWELL, OKLAHOMA.

Oklahoma State Univ., Goodwell. Agricultural Research.

For primary bibliographic entry see Field 03F. W71-08149

BREAKTHROUGH SOUGHT IN GRAIN

SORGHUM PRODUCTION,
Nebraska Univ., Lincoln. Dept. of Sorghum Physiology; and Agricultural Research Service, Lincoln, Nebr.

For primary bibliographic entry see Field 03F. W71-08151

2J. Erosion and Sedimentation

POTENTIAL ENERGY AND STREAM MORPHOLOGY,

Illinois State Water Survey, Urbana; and Illinois Univ., Urbana. Water Resources Center. Chih Ted Yang.

Water Resources Research, Vol 7, No 2, p 311-322, Apr 1971. 12 p, 6 fig, 1 tab, 15 ref. OWRR Project B-023-ILL (2).

Descriptors: *Drainage patterns (Geologic), *Profiles, *Geomorphology, *Mathematical models, *Free energy, Entropy, Geologic control, Stochastic processes, Head loss, Energy dissipation, Energy gradient, Hydraulic gradient. Identifiers: *Stream order, Potential energy.

Use of the analogy of entropy in thermodynamics reveals two basic laws which govern the formation of all stream systems. The first law is the law of average stream fall, which states that under the dynamic equilibrium condition the ratio of average fall between any two different order streams in the same river basin is unity. The second law is the law of least rate of energy expenditure, which states that during the evolution toward its equilibrium condition a natural stream chooses its course of flow in such a manner that the rate of potential energy expenditure per unit mass of water along this course is a minimum. This minimum value depends on the external constraints applied to the stream. The concavity of a river basin is shown to be the determinative factor in the formation of a stream system. On the basis of Horton's law and the law of average stream fall, longitudinal stream profiles can be calculated. The agreement between observed data and the theories found in this study is excellent. (Knapp-USGS) W71-07705

NAVIGATION AND SEDIMENTATION CONDITIONS AT TYPICAL LOCK AND DAM, ARKANSAS RIVER, ARKANSAS AND RIVER, OKLAHOMA,

Army Engineer Waterways Experiment Station,

Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-07804

GEOMETRY AND TOPOLOGY OF STREAM NETWORKS,

Purdue Univ... Purdue Univ., Lafayette, Ind. Dept. of Geosciences; and Toronto Univ. (Ontario). Dept. of Civil Engineering.

For primary bibliographic entry see Field 07A.

EROSION AND SEDIMENTATION, Geological Survey, Washington, D.C

For primary bibliographic entry see Field 05C. W71-07939

THE COLLAPSE OF SOLIFLUCTION LOBES AS A FACTOR IN VEGETATION AS A FACTOR IN VEGETATION BLOCKFIELDS, Portland State Univ., Oregon. Dept. of Geography.

For primary bibliographic entry see Field 02C W71-07954

HYDROGRAPHY AND HOLOCENE SEDIMENTATION OF THE MERRIMACK RIVER ESTUARY, MASSACHUSETTS,

Massachusetts Univ., Amherst. Dept. of Geology. For primary bibliographic entry see Field 02L. W71-07967

SEDIMENT TRANSPORT IN FLOW DISTURBED BY RAINFALL,

Texas A and M Univ., College Station. Dept. of Civil Engineering. Jerry L. Machemehl.

Partly supported by FWQA. Water Resources Bulletin, Vol 7, No 2, p 317-329, Apr 1971. 13 p, 6 fig.

Descriptors: *Sediment transport, *Open channel flow, *Overland flow, *Rainfall, *Impact (Rainfall), *Turbulence, Turbulent flow, Hydraulic

models, Sediment control, Sedimentation, Erosion, Precipitation (Atmospheric), Bed load, Suspended

Identifiers: Rainfall-sedimentation relations.

Studies were conducted in a closed system recirculating research flume to evaluate the relative effects of high intensity rainfall on von Karman's universal constant and the sediment transport capacity of shallow flow. The tests in this study were conducted at flow depths of 0.3 ft and less with discharges less than 0.5 cfs. Point sediment samples were siphoned from the flow with a stainless steel-pipette sediment sampler. Sediment concentrations were found with a filtering technique. Sediment samples were taken with and without rainfall to evaluate the relative effect of the rainfall on the transport capacity of shallow flow. Suspended sediment reduces the value of the von Karman's universal constant. The reduction of K with suspended sediment indicates that mixing is less effective and that the sediment tends to suppress or dampen out turbulence. Rainfall and suspended sediment reduces the value of von Karman's universal constant of turbulent exchange which characterizes the effectiveness of the turbulence in transferring momentum. Reduction of K means that the mixing is less effective and the simulated rainfall and suspended sediment tend to suppress the turbulence. The suspended load transport capacity of the flow appears to be reduced under simulated rainfall conditions due to a reduction in von Karman's universal constant. (Knapp-USGS)

DISTRIBUTION, COMPOSITION AND TRANS-PORT OF SUSPENDED SEDIMENT IN REDON-DO SUBMARINE CANYON AND VICINITY (CALIFORNIA),

University of Southern California, Los Angeles. Dept. of Geological Sciences. R. M. Beer, and D. S. Gorsline.

Marine Geology, Vol 10, No 3, p 153-175, Mar 1971. 23 p, 10 fig, 27 ref. ONR Grant GB 6913 NSF Contract Nonr 228 (17), NR 083-144.

Descriptors: *Suspended load; *Sediment transport, *Turbidity currents, Density currents, California, Sedimentation, Erosion, Suspension, Turbidity, Continental slope, Density. Identifiers: Redondo Submarine Canyon (Calif).

Redondo Canyon, in the southern half of Santa Monica Bay, California, is an active submarine canyon through which sands and silts are transported by periodic submarine slides and turbid flows. Stream, surface waves, rip currents, and internal waves are capable of placing sediment into suspension over the continental shelf. Submarine slumping is also a primary mechanism for the suspension of material within submarine canyons. This material is transported over the shelf by density suspension at the thermocline, suspension by internal waves, and near-bottom currents. The subsurface distribution of suspended sediment is controlled by the canyon's topographic effects on current flow. Near the bottom, suspended loads are very large. It is within this zone that some of the largest suspended loads occur, apparently due to the suspension of material by bottom turbulence created by near-bottom currents, as well as the presence of material suspended from the nearshore area in the process of seaward transport. (Knapp-USGS) W71-08064

NEWPORT SUBMARINE CANYON, CALIFOR-NIA: AN EXAMPLE OF THE EFFECTS OF SHIFTING LOCI OF SAND SUPPLY UPON CANYON POSITION,

University of Southern California, Los Angeles.

Dept. of Geological Sciences. D. W. Felix, and D. S. Gorsline.

Marine Geology, Vol 10, No 3, p 177-198, Mar 1971. 22 p, 10 fig, 1 tab, 34 ref. ONR Contract Nonr (228)-17 NR 083-144; NSF Grant GB-6913.

Erosion and Sedimentation—Group 2J

Descriptors: *Suspended load, *Sediment transport, *Turbidity currents, Density currents, California, Sedimentation, Erosion, Suspension, Turbidity, Continental slope, Density.
Identifiers: *Newport Submarine Canyon (Calif).

Newport Submarine Canyon, located off Newport Beach, California, is typical of the small shelf canyons of the California continental borderland. The canyon has formed at a point where the shelf is narrow and sand moved by waves in longshore drift is concentrated at a convergence zone. The present topographic expression of the submarine canyon represents its most recent position, but one that is represents its most recent position, but one that is now in process of abandonment as a result of shifts in loci of sand input. The Santa Ana River is the principal local sand source. Changes in the location of the river mouth during the past century have shifted the point of longshore drift convergence and sand concentration approximately one kilometer positives. ter northwest of the present canyon head. The canyon head is now receiving only fine organic-rich sediments that are building an apparently stable deposit that will ultimately fill the head. Thus, the locale illustrates the process of canyon origin, development and ultimate abandonment. (Knapp-HSGS) W71-08065

SAND WAVES IN THE NORTH SEA OFF THE COAST OF HOLLAND,

University of East Anglia, Norwich (England). School of Environmental Sciences. I. N. McCave.

Marine Geology, Vol 10, No 3, p 199-225, Mar 1971. 27 p, 18 fig, 49 ref.

Descriptors: *Sand waves, *Sediment transport, *Bed load, *Bottom sediments, Waves (Water), Suspended load, Sands, Ripple marks, Sedimentation, Shoals, Coasts, Sand bars, Shallow water. Identifiers: *North Sea, *Holland.

Four quarterly surveys were made of the sand-wave field of the North Sea in 1968-1969. Crest heights have a maximum of 7 m, decreasing to 2 m in the north and towards the coast. Wavelengths are from 200 to 500 m. Symmetrical and asymmetrical sand waves, and sand waves with superimposed megarip-ples are recognized. The northern boundary to the sand-wave field is caused by decreasing asymmetry of the tidal ellipse. This does not occur in a narrow tongue extending along the coast of Texel where an extension of the sand-wave field is found. The northwards decrease in height is mainly caused by increase in suspension transport of sand. Megaripples on sand waves are taken to be large scale analog of ripples on dunes seen in flumes. The megaripples represent perturbation of bed-load transport rate and the sand waves perturbation of suspended load transport rate. Thus the northwards absence of megaripples on sand waves, decrease in grain size, decrease in height and increase in suspension transport, fit in a coherent dynamical explanation of the characteristics of the sand-wave field. (Knapp-USGS) W71-08066

TRANSPORT OF BEDLOAD AS RIPPLES DUR-

ING AN EBB CURRENT,
Washington Univ., Scattle. Dept. of Oceanography.
Nancy B. Kachel, and Richard W. Sternberg. Marine Geology, Vol 10, No 4, p 229-244, Apr 1971. 16 p, 8 fig, 2 tab, 20 ref, append. USAEC Contract No AT (45-1)-2220; NSF Grant Contract GA11149.

Descriptors: *Sediment transport, *Tides, *Bed load, *Ripple marks, Sands, Model studies, Hydraulic models, Sand waves, Turbulence, Velocity, Washington. Identifiers: *Puget Sound (Wash).

A large instrumented tripod was used during a period of relatively strong ebb current in Puget Sound, to measure simultaneously the currents within 1.5 m of the sea bed and the changing ripple configuration of a sandy bottom. Measurement of the heights and migration rates of the ripples on time-lapse stereo photographs made it possible to calculate the amount of sediment moved. From the measured velocity profiles, the shear velocity and the fluid power expended on the bed were determined. These measurements of mass transport are compared with the values predicted by several existing bedload transport theories. Einstein's and Yalin's equations predict values with the appropriate trend of the curve of mass transport vs. shear velocity, but their values are too large, because of a difference in the boundary shear stress measurement used in the comparison. Bagnold re-lates immersed weight of transported sediment to fluid power by a proportionality coefficient, K, which reaches a constant maximum value for any system. Present measurements indicate that K increased exponentially with the growth of ripples, which in turn were related to the flow conditions. When compared with flume data, the mass transport of sediment was adequately predicted. It appears that K does not reach a constant value in most marine environments but is related to the sediment characteristics, the shear stress, and the turbulence of the flow. (Knapp-USGS)

EROSION OF UTTAR PRADESH SOILS BY WATER AND ITS RELATION TO SOIL PRO-PERTIES.

Allahabad Univ. (India). Dept. of Chemistry. Anupam Varma, and S. K. De. Journal of Soil and Water Conservation in India, Vol 18, Nos 1 and 2, p 76-82, Jan-June 1970. 7 p, 2 tab, 17 ref.

Descriptors: *Soil erosin, *Soil physical properties, *Soil chemical properties, Topography, Slopes, Laboratory tests, Soil texture, Soil chemistry, Leaching, Soil conservation. Identifiers: *India, Uttar Pradesh (India).

Observations made in the laboratory on erosion of some Uttar Pradesh soils were correlated with soil properties. The extent of erosion by water depends not only on the time of contact of the soil by water but also on the slope percentage and physico-chemical properties of soils. Further, soils from different climatic regions behave differently so far as the extent of erosin is concerned, although they may be of the same texture. With the doubling of slope percentage, the extent of erosion doubled or more than doubled. The erosion rate appeared to be correlated with the time and the amount of soil left after erosion. The rate of erosion is directly proportional to the ionic concentration of the soil. (Knapp-USGS) W71-08074

CHEMICAL CHARACTERISTICS OF FRACTIONATED HUMIC ACIDS ASSOCIATED WITH MARINE SEDIMENTS, Bedford Inst., Dartmouth (Nova Scotia).

For primary bibliographic entry see Field 02K. W71-08090

AN INFRA-RED STUDY OF CLAY MINERALS. 1. THE IDENTIFICATION OF MONTMORIL-LONITE-TYPE CLAYS IN MARINE SEDI-

Liverpool Univ. (England). Dept. of Oceanog-

R. Chester, and H. Elderfield. Chemical Geology, Vol 7, No 2, p 97-105, Mar 1971. 9 p, 1 fig, 3 tab, 16 ref.

*Clay minerals, *Analytical Descriptors: *Clay minerals, *Analytical techniques, *Infrared radiation, Expansive clays, Water chemistry, Ion exchange, Mineralogy, Spectrometers, Spectroscopy, Sediments, Bottom sedi-

Identifiers: Infrared spectroscopy.

The infrared spectra which result from reacting fifteen organic materials (including monohydric and

polyhydric alcohols, hydrocarbons amines and azo dyes) with samples of the clay minerals illite, chlorite, kaolinite and montmorillonite were determined. A complex is formed between 2,2-dipyridyl and montmorillonite. The complex is specific to montmorillonite, and replaces water molecules in inter-sheet positions in the clay structure. This complex is made the basis of an infrared technique which may be used to identify expanding lattice clays in multi-clay samples. The technique may be applied to marine sediments, and is described in detail. (Knapp-USGS) W71-08091

POSSIBILITY OF PREDICTING WATER TUR-BIDITY AS ILLUSTRATED BY THE OKA RIVER BASIN (RUSSIAN: O VOZMOZHNOSTI PREDSKAZANIYA MUTNOSTI VODY NA PRIMERE REK BASSEYNA OKI),

I. V. Starostina.

Meteorologiya i Gidrologiya, No 12, p 73-79, Dec 1970. 7 p, 3 fig, 4 ref.

Descriptors: *Runoff forecasting, *Turbidity, *Sediment transport, *Sediment discharge, *Suspended load, Snowmelt, Seasonal, Snow cover, Watersheds (Basins), Channel erosion, Air temperature, Precipitation (Atmospheric), Ero-

sion, Foreign research. Identifiers: *USSR, Oka River, Kaluga Oblast, Ice crust, Slope erosion.

Because of its typical river sediment formation and regime the Oka River basin near Kaluga was studied with respect to methodology applications for predicting water turbidity. Data from observations of suspended sediments for five discharge sites on of suspended sediments for five discharge sites on rivers of the forest and forest-steppe zone were used. The average long-term turbidity value varied between 100 and 1,500 g/cu m; variability was measured by variation coefficients of 0.35-0.70. Maximum turbidity, formed by melt waters, preceded maximum water discharge at sites of the forest zone by 3-10 days and at sites in the forest-steppe zone by 1-3 days. Predictions of daily turbidity of the Oka River at Kaluga can be made for a period of 5-12 days, beginning from the first day period of 5-12 days, beginning from the first day when snowmelt is vigorous and from the 7th to 8th day when snowmelt is slow, provided turbidity is above 100 g/cu m. Best results in predicting turbidity are obtained for spring periods with a vigorous snow thaw covering the entire basin. Turbidity of two- and three-peak high waters is more difficult to predict. Turbidity in years during which a basin is more than 80% covered by ice or has no ice crust at all is impossible to predict. (Josefson-USGS) W71-08101

RELATIONSHIP BETWEEN THE RATE OF SHORE DEFORMATION AND FLOW VELOCITY (RUSSIAN: ZAVISIMOST' INTENSIVNOSTI BEREGOVYKH DEFORMATSIY OT SKOROSTI POTOKA), Moscow State Univ., (USSR).

For primary bibliographic entry see Field 08B. W71-08102

MORPHOLOGICAL SLOPE EVOLUTION BY LINEAR AND SURFACE DEGRADATION, Wroclaw Univ. (Poland). Inst. of Geography.

Alfred Jahn.

Geographia Polonica, No 14, p 9-21, 1968. 13 p, 7

Descriptors: *Degradation (Stream), *Geomorphology, *Slopes, *Erosion, *Rocks, Glaciation, Weathering, Gully erosion, Quaternary period, Geologic time, Tertiary period, Petrog-

raphy, Orography.
Identifiers: *Poland, Carpathian Mountains, Sudeten Mountains, Slope profile, Linear erosion, Surface degradation.

The slope is treated as a surface which undergoes degradation due to denuding agents and the erosive

Group 2J—Erosion and Sedimentation

incision of water channels. Erosive decrements in rock mass may be calculated by comparing the slope surface as it is today with visible forms deviating in plus values (Klippen under conditions of surface degradation) or in minus values (dissection where linear degradation has taken place). Examples cited from the Sudeten and the Carpathians where slopes were treated in their totality show that the removal of rock mass is caused primarily by the erosive action of water. It is believed that the action of water running down a slope in small rills may gradually induce (especially in soft rock types) a complete modification of the slope, including its recession. Surface degradation effects all types of rocks without much variety in its way of acting. Often the susceptibility of rock to erosive dissection determines the ultimate evolution of a slope. The morphological difference between a slope of soft rocks and massive rocks resolves itself into a difference in resistance of the rock material to linear erosion, with weathering as an intermediate process. This explains the difference in slope forms between the Carpathians and the Sudeten, or the striking contrast apparent in the slopes of Sleza and Radunia, the two mountains close to each other in the Sudeten forefield. Erosive dissection of rock material is an important process in slope degradation and recession, probably more important than surface degradation. (Josefson-USGS) W71-08106

NEO-PLEISTOCENE CHANGES IN A LARGE RIVER VALLEY USING THE ORDER AS AN EXAMPLE,

Wroclaw Univ. (Poland). Inst. of Geography For primary bibliographic entry see Field 02C. W71-08107

THE DYNAMICS OF SEDIMENTARY EN-VIRONMENTS IN THE LIGHT OF HISTO-GRAM TYPES OF GRAIN ABRASION, Adam Mickiewicz Univ., Poznan (Poland). Inst. of

Geography. Ludwika Krygowska, and Bogumil Krygowski. Geographia Polonica, No 14, p 87-92, 1968. 6 p, 3

fig, I tab, 12 ref.

Descriptors: *Deposition (Sediments), *Abrasion, *Sediments, *Histograms, Sieve analysis, Particle size, Beaches, Dunes, Sands, Weathering, Granites,

Till, Rivers, Gravels.
Identifiers: *Poland, Grain abrasion, Sand grains.

Numerous attempts have been made to determine the dynamics of sedimentary environments from studies of the deposits left by them. These attempts have mostly been based on the structure of the deposit, its particle-size composition and, less often, its grain abrasion. By applying mechanical graniformametry, a relatively rapid determination of grain abrasion from a large number of samples is possible. Conclusions derived in the present work are based on an examination of more than 1,500 samples collected from 8 different sedimentary environments and on several thousand analyses (abrasion tests) by means of their graniformameter. The source material confirms the view that a sedimentary environment of deposition and its dynamics are characterized by more than one parameter. The parameters considered here are the coefficient of grain abrasion, the coefficient of abrasion irregularity and the histogram type of grain abrasion. (Josefson-USGS) W71-08108

THE EASTERN SIBERIAN KARST.

Wroclaw Univ. (Poland). Inst. of Geography. Marian Pulina.

Geographia Polonica, No 14, p 109-117, 1968. 9 p, 6 fig, 1 tab, 19 ref.

Descriptors: *Karst, *Chemical degradation, *Erosion, *Topography, Orography, watershead (Basins), Caves, Meteorological data, Hydrogeolo-*Topography, Orography, Watersheds gy, Salts.

Identifiers: *Eastern Siberia, Siberian Platform, Irkutsk Amphitheater, Karst rocks, Karst hydrography, Karst regionalization, Karst relief.

To study chemical karst denudation, karst phenomena in the Siberian platform and in the mountain regions of the Eastern Sayan Ridge and Chamar-Daban on the Baykal shore, constituting part of the 'Irkutsk Amphitheater,' are examined. The areas covered by soluble rocks occupy some 30% of the surface of the Irkutsk Amphitheater, equivalent to a total of more than 300,000 sq km. The overall chemical denudation for karsted and nonkarsted areas comprising the Angara and the Baykal drainage basins totals more than 3 cu m/sq km/yr. With regard to mineral material carried by the Angara, chemical degradation accounts for 10-20%. Results obtained show that the best developed karst relief of the Siberian Platform lies in the Irkutsk Amphitheater. In the mountain areas of the Irkutsk Amphitheater the evolution of karst relief is insignificant, with older karst forms surviving merely in relict form. The effect of present day chemical denudation in Eastern Siberia fluctuates between 2 and 60 cu m/sq km/yr, representing, at most, one half of the values for European karst regions in a temperature climate at similar geographical latitudes. The new large storage basin for the Bratsk hydroelectric plant in the Angara valley, by raising the water level 60 m within the karst regions, has revived old forms of surface karst and caverns. The chemical infiltration of active transitory waters of the Angara is leading to the transformation of older and the creation of new karst mesoforms. (Josefson-USGS) W71-08109

ERODIBILITY OF SLOPES (PHASE I),

California State Div. of Highways. Materials and Research Dept. **Travis Smith**

Available from the National Technical Information Service as PB-196 526, \$3.00 in paper copy, \$0.95 in microfiche. Interim Report No M and R 632101,

Descriptors: *Highways, *Erosion control, *Soil tests, Slopes, Test procedures, California, Sampling.

The results of a literature search and the results of a preliminary laboratory testing program, are presented. Based upon past research by the U.S. Department of Agriculture and other agencies, it now appears that erosion potential of a given soil can be evaluated by appropriate laboratory tests, the two most promising being the 'Dispersion ratio' and the 'surface aggregation ratio'. Preliminary test results utilizing both tests were reasonably consistent. The use of larger samples and a lesser degree of sample disturbance are expected to improve reproducibility. W71-08171

2K. Chemical Processes

DEVELOPMENT OF INSTRUMENTAL TECHNIQUES FOR THE ANALYSIS OF TRACE ORGANIC CONSTITUENTS IN WATER. Connecticut Univ., Storrs.

For primary bibliographic entry see Field 05A. W71-07839

ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS, Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry.

For primary bibliographic entry see Field 05D. W71-07910

STEAM FILM SAMPLING OF WATER FOR MASS SPECTROMETRIC ANALYSIS OF THE DEUTERIUM CONTENT, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.; and Atomic Energy of Canada Ltd., Chalk River (Ontario). General Chemistry Branch.
W. M. Thurston.
The Review of Scientific Instruments Instruments and Atomic The Review of Scientific Instruments.

The Review of Scientific Instruments, Vol 42, No 5, p 700-703, May 1971. 4 p, 5 fig, 2 tab, 3 ref.

Descriptors: *Sampling, *Water chemistry, *Steam, *Deuterium, *Analytical techniques, Spectrometers, Hydrogen, Radioisotopes, Water vapor, Water temperature, Heat transfer, Test procedures, Salinity, Dissolved solids, Stable isotopes. Identifiers: *Mass spectrometry.

The Leidenfrost effect, characterized by film boiling of a liquid adjacent to a hot metal surface was adapted in two forms for sampling water vapor for mass spectrometer analysis to determine the deuterium-to-hydrogen (D/H) ratio. Both a hot probe and a hot plate configuration convert liquid water to vapor without interference from dirt or dissolved material in the liquid phase. Automatic and semiautomatic analysis of the D/H ratio in water was achieved with a precision of 0.1 ppm at natural deuterium concentrations. A 2 min cycle time was used for multiple sampling of bulk water and flow-ing stream samples. (Woodard-USGS)

GEOCHEMISTRY OF WATER, Geological Survey, Washington, D.C For primary bibliographic entry see Field 05C.

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC, REPORT OF PROGRESS, JUNE 1969 THROUGH JUNE 1970, Washington Univ., Seattle. Dept. of Oceanography. For primary bibliographic entry see Field 05C.

HYDROGRAPHIC OBSERVATIONS IN THE EASTERN IRISH SEA WITH PARTICULAR REFERENCE TO THE DISTRIBUTION OF NUTRIENT SALTS,

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab. For primary bibliographic entry see Field 05B.

0-18/0-16 RATIOS AND RELATED TEMPERA-TURES OF RECENT PTEROPOD SHELLS (CAVOLINIA LONGIROSTRIS LESUEUR) FROM THE PERSIAN GULF,

Goettingen Univ. (West Germany). Geological-Paleontogical Inst.

J. Hoefs, and M. Sarnthein. Marine Geology, Vol 10, No 4, p M 11-M 16, Apr 1971. 6 p 1 fig, 1 plate, 1 tab, 11 ref.

Descriptors: *Stable isotopes, *Sedimentation rates, *Oxygen, *Sedimentation, *Water temperature, Water analysis, Plankton, Calcium carbonate. Identifiers: *Oxygen isotopes, Pteropods.

The temperatures obtained by mass spectrometric measurements of the 0-18/0-16 ratio of Recent pteropod shells from the Persian Gulf correlate relatively with the actual temperature and salinity conditions found in the Gulf. This argues for an autochthonous plankton shell production in the whole investigation area. Still problematic are the questions of when and where in the water column the carbonate is incorporated into the skeleton, and of how to exclude inhomogeneities in plankton sediment samples from areas with very low sedimentation rates and active bioturbation. (Knapp-USGS)

W71-08068

IRON IN THE MULLICA RIVER AND IN GREAT BAY, NEW JERSEY,
Princeton Univ., N.J. Dept. of Geological and

Geophysical Sciences

For primary bibliographic entry see Field 02L. W71-08089

CHEMICAL CHARACTERISTICS OF FRACTIONATED HUMIC ACIDS ASSOCIATED WITH MARINE SEDIMENTS,

Bedford Inst., Dartmouth (Nova Scotia).

M. A. Rashid, and L. H. King. Chemical Geology, Vol 7, No 1, p 37-43, Jan 1971. 7 p, 2 tab, 17 ref

Descriptors: *Humic acids, *Chemical analysis, *Chromatography, *Bottom sediments, *Sea water, Organic matter, Organic acids, Water analy-

Identifiers: Marine sediments.

Humic acids were fractionated on the basis of molecular weight ranges by using a column chromatographic technique with different grades of Sephadex gels. Further studies on these fractions suggest that the major oxygen-containing functional groups are concentrated on the low molecular feeting. lar weight fractions. The C/H ratios increase with the increasing molecular weight. (Knapp-USGS) W71-08090

AN INFRA-RED STUDY OF CLAY MINERALS.

1. THE IDENTIFICATION OF MONTMORILLONITE-TYPE CLAYS IN MARINE SEDI-MENTS.

Liverpool Univ. (England). Dept. of Oceanog-

For primary bibliographic entry see Field 02J.

BACTERIAL PROCESSES IN THE OXIDATION AND LEACHING OF SULFIDE-SULFUR ORES OF VOLCANIC ORIGIN,
Akademiya Nauk SSSR, Moscow. Institut Mikrobiologii.

M. V. Ivanov.

Chemical Geology, Vol 7, No 3, p 185-211, Apr 1971. 27 p, 15 fig, 10 tab, 21 ref.

Descriptors: *Oxidation, *Leaching, *Sulfur, *Volcanoes, *Sulfur bacteria, Sulfates, Sulfides, Mining, Surveys, Geochemistry, Weathering. Identifiers: *USSR.

Various gaseous sulfur compounds constitute a part of volcanic gases in all stages of their evolu-tion, beginning with eruption of melted lava and in-cluding post-volcanic solfatara activity. Under surface and near-surface conditions, native sulfur separates from volcanic sulfurous gases. More or less substantial sulfur deposits are widely distributed in regions of active volcanism. In Central and South America, Indonesia, Japan, and some other countries, sulfur of volcanic origin is obtained in commercial quantities. In the U.S.S.R., sulfur deposits and sulfur-shows of volcanic origin are found in many places of the Kamchatka peninsula and the Kuril Islands. Processes of sulfur oxidation to sulfuric acid with the participation of Thiobacillus thiooxidans occurs in the near-surface zones of sulfide-sulfur ores of the impregnationmetasomatic sulfur deposits in the Kuril-Kamchatka region. Sulfide minerals decompose in a sulka region. Sulfide minerals decompose in a sul-furic-acid medium formed in the oxidation zone; simultaneously, iron is carried out by acid waters and redeposited from solutions along the periphe-ries of the oxidation zones. In the oxidation process, new formation of secondary sulfate minerals takes place, while migration of silica and onal redeposition is chearted in sought descripopal redeposition is observed in several deposits. Alunite, silicon minerals and rutile are the stable minerals in the sulfuric-acid weathering zone.
Therefore, formation of porous quartz-opal rocks is
the end result of oxidation and leaching of sulfidesulfur ores. (Knapp-USGS)

LIMESTONE SOLUTION WITHIN THE EAST MENDIP AREA, SOMERSET, Saskatchewan Univ., Regina. Dept. of Geography. For primary bibliographic entry see Field 02F.

PRELIMINARY RESULTS OF AN APPLICA-TION OF THE PROCEDURE FOR THE MEA-SUREMENT OF AGGRESSIVENESS OF WATER TO CALCIUM CARBONATE, For primary bibliographic entry see Field 02F. W71-08118

THE SOURCE IDENTIFICATION OF MARINE HYDROCARBONS BY GAS CHROMATOG-

RAPHY, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05A. W71-08155

2L. Estuaries

REDEFINITION OF SALINITY,

Scientific Committee on Oceanic Research; and International Council for the Exploration of the Sea, Hydrography Committee; and International Association of the Physical Sciences of the Ocean.
Warren S. Wooster, Arthur J. Lee, and Gunter

Journal of Marine Research, Vol 27, No 3, p 358-360, 1969, 6 ref.

Descriptors: *Salinity, *Measurement, *Water analysis, Sea water, Analysis, Electrical conductance, Conducitivity, Analytical techniques, Oceanography.
Identifiers: UNESCO, International Oceanographic

Tables, Salinity redefinition.

According to the old definition, salinity was expressed in g of dissolved solid material per kg of sea water following substitution of bromine by an equivalent quantity of chlorine, conversion of carbonates to oxides, and destruction of organic matter. This complicated procedure was usually replaced by a questionable empirical formula: S 0.1% — 0.030 ... 1.8050 Cl 0.1%. With the introduction of electrical conductivity analyses, the salinity was defined as 1.80655 Cl 0.1% and the chlorinity was converted to salinity on the basis of According to the old definition, salinity was exthe polynomial computed by using least squares.
This formula permitted construction of the International Oceanographic Tables, including conductivity ratios from 0.85000 to 1.17999 and the range of salinity from 29,196 to 42,168 0.1%. Oceanographers are encouraged to use the new definition of salinity. (Wilde-Wisconsin) W71-07874

STUDIES OF PRIMARY PRODUCTIVITY IN COASTAL WATERS OF SOUTHERN LONG ISLAND, NEW YORK,

Dow Chemical Co., Freeport, Tex; and Puerto Rico Univ., Mayguez. Dept. of Marine Sciences; and Town of Hempstead, N.Y. Dept. of Conservation and Waterways; and Virgin Islands Coll., St. Thomas.

E. F. Mandelli, P. R. Burkholder, T. E. Doheny, and R. Brody.

Marine Biology, Vol 7, No 2, p 153-160, 1970. 9 fig, 2 tab, 34 ref.

Descriptors: *Primary productivity, *Coasts, *Phytoplankton, *Estuaries, *Standing crop, Seasonal, Diatoms, Dinoflagellates, Chlorophyll, Photosynthesis, Temperature, Sampling, Salinity, Dissolved oxygen, Nutrients, Carbon radioisotopes, Phosphates, Silicates, Solar radiation, Depth, Therefore, The Company of the Carbon radioisotopes, Phosphates, Silicates, Solar radiation, Depth, Therefore, The Carbon radioisotopes, Phosphates, Silicates, Solar radiation, Depth, Therefore, The Carbon radio of the Car mocline, Nitrates, Light intensity, Eutrophication,

mocline, Nitrates, Light Intensity, Eutrophication, Marine algae, Sea water, New York.
Identifiers: *Coastal waters, *Southern Long Island, Skeletonema costatum, Thalassiosira, Chaetoceros, Rhizosolenia alata, Peridinium depressum, Peridinium pallidum, Ceratium massilense, Ceratium furca, Ceratium tripos, Ceratium

macroceros, Noctiluca miliaris, Gymnodinium splendens, Exuviella marina, Eutreptia, Nitzschia seriata, Thalassionema nitzschoides, Asterionella japonica, Chlorophyll-a.

In conservation of coastal marine resources, maintenance of natural primary productivity of coastal waters is significant. During 1966, monthly determinations of phytoplankton productivity of tidal esturaries and coastal waters of southern Long Island were made. Sustained blooms of green flagellates and dinoflagellates were found during prints and summer in sections were in coastal. spring and summer in estuarine waters; in coastal areas alternating abundances of diatoms and dinoflagellates dominated the standing crop during dinoflagellates dominated the standing crop during late winter, early fall, and summer. The chlorophyll-a distribution in estuaries exhibited two patterns, lasting about six months each, with concentration ranging from 1.0 to 27.6 mg/cu m. In the coastal areas its distribution showed a reversed pattern with range from 1.45 to 10.15 mg/cu m. Vertical distribution of chlorophyll-a within the coastal region euphotic zone showed similar patterns both nearshore and offshore. Mean photosynthesis rates per unit of chlorophyll-a varied from 3.1 to 3.5 mg carbon/mg chlorophyll-a/hour; at light saturation, ratio varied with water temperature and species composition. Mean primary productivity values were 0.35, 0.22, 0.16 g carbon/cu m per day for estuaries, nearshore, and offshore areas, respectively, decreasing seaward. offshore areas, respectively, decreasing seaward. (Jones-Wisconsin) W71-07875

HIGH MOLECULAR WEIGHT ALGAL SUB-STANCES IN THE SEA,

Naval Undersea Research and Development Center, Pasadena, Calif.
J. W. Hoyt.

Marine Biology, Vol 7, No 2, p 93-99, 1970. 3 fig, 3 tab, 19 ref.

Descriptors: *Molecular structures, *Algae, *Fluid friction, *Littoral, Plant growth substances, Phytoplankton, Fluid mechanics, Exudation, Oceans, Chlorophyta, Phaeophyta, Rhodophyta, Marine bacteria.

Malthe Dactina.

Identifiers: *High molecular weight compounds, *Molecular size, *Algal exudates, Extracellular material, Turbulent friction, Seaweed, Porphyridium cruentum, Porphyra, Gigartina.

Turbulent-flow measurements in a special rheometer revealed that commercial seaweed extracts and certain members of phytoplankton have extracellu-lar materials of large molecules with weights exceeding 50,000. Extracts from a variety of littoral algae, particularly of Porphyra and Gigartina genera, have changed the turbulent friction thereby indicating the presence of high-polymer sub-stances. Porphyridium cruentum produced friction reduction as high as 60%. Results suggest that algal exudates are the source of high molecular com-pounds in the sea. (Wilde-Wisconsin) W71-07878

THERMOSTABILITY OF LITTORINA MOL-LUSKS AS RELATED TO ENVIRONMENTAL CONDITIONS OF DIFFERENT SPECIES (IN RUSSIAN),

Akademiya Nauk SSSR, Vladivostok. Institut

For primary bibliographic entry see Field 05C. W71-07888

RELATION OF THE PHYTOPLANKTON TO TURBULENCE AND NUTRIENT RENEWAL IN

CASCO BAY, MAINE, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05C. W71-07889

HYDROGRAPHY AND HOLOCENE SEDIMEN-TATION OF THE MERRIMACK RIVER ESTUARY, MASSACHUSETTS, Massachusetts Univ., Amherst. Dept. of Geology.

Field 02—WATER CYCLE

Group 2L—Estuaries

Allan D. Hartwell. California University Department of Geology Contribution No 5-CRG, 1970. 166 p, 62 fig, 32 ref. ONR Contract Nonr N00014-67-A-0230-0001 Task Order NR388-084.

Descriptors: *Hydrography, *Sedimentation, *Estuaries, *Massachusetts, Tidal effects, Streamflow, Runoff, Sediment distribution, Particle size, Water circulation, Sediment transport, Currents (Water), Salinity, Alluvial channels, Deltas, Flood-

Identifiers: *Merrimack River estuary (Mass).

The Merrimack River estuary is situated on glaciated terrain along the coast of northeastern Massachusetts. When the tide floods during periods of normal and high runoffs, a sharp, slightly tilted boundary develops between the intruding salt-water mass and the overriding fresh water. The salt water from the ocean is deflected to north. The water from the ocean is deflected to north. The fresh water ponds up on the south side, where a significant amount of the suspended sediment and pollutant load carried by the river is deposited. When discharge drops below approximately 3000 cfs, the stratification disappears and the estuary becomes partially mixed. Maximum ebb-current velocities, which are frequently twice a strong velocities, which are frequently twice as strong as flood-current velocities, are concentrated in the surface portion, whereas maximum flood-current velocities occur near the river bottom. The distribution of bottom sediments is closely related to the hydraulic circulation pattern, tidal current velocities, bottom topography, and sediment source areas. (Woodard-USGS)

POPULATION DYNAMICS AND SALINITY TOLERANCE OF HYADESIA FUSCA (LOHMAN) (ACARINA, SARCOPTIFORMES) FROM BRACKISH WATER ROCKPOOLS, WITH NOTES ON THE MICROENVIRONMENT INSIDE ENTEROMORPHA TUBES, Stockholm Univ. (Sweden). Asko Lab.; and Stockholm Univ. (Sweden). Dept. of Zoology. For primary bibliographic entry see Field 05C. W71-08026

ENVIRONMENTAL FACTORS CONTROLLING THE EPIPSAMMIC FLORA ON BEACH AND SUBLITTORAL SANDS,

Marine Lab., Aberdeen (Scotland); and Puerto Rico Univ., Rio Piedras. Inst. of Marine Biology. J. H. Steele, A. L. S. Munro, and G. S. Giese. Journal of the Marine Biological Association of the United Kingdom, Vol 50, p 907-918, 1970. 8 fig, 2 tab. 14 ref

Descriptors: *Marine plants, *Beaches, *Sands, *Ocean waves, *Environmental effects, Drainage, Oxygen, Organic matter, Microorganisms, Pumping, Chlorophyll, Diatoms, Depth, Algae, Sulfides, Tidal effects, Bacteria, Marine microorganisms, Energy, Littoral.

Identifiers: *Epipsammic flora, *Sublittoral, Scotland, Beach level, Firemore (Scotland), Rhodamine B, Interstitial water movement, Sand

Beach level alterations, sand mixing by wave action, water percolation due to pressure changes associated with waves, and water drainage into beaches were studied on an exposed beach in Scotland. Results suggests that drainage is the dominant effect on the littoral zone in supplying oxygen and organic matter to the interstitial microflora. Sublittorally, pumping due to wave action may be important. On exposed beaches, effect of wave action in mixing and redistributing surface layer of sand will determine particle size and inhibit formation of algal surface mats and unattached debris accumulation. These effects are insufficient to explain the different depth distributions of chlorophyll, the oxygen profile differences, and the sulfide accumulations below 5 to 10 cm in sand offshore but not at low water mark. Main energy flow into interstitial ecosystem is by uptake of soluble organic matter by bacteria attached to sand grains. Decreased rate of sand mixing offshore and increased water movement at low water can explain differences in chlorophyll profiles in littoral and sublittoral areas but do not reveal the mechanisms by which diatoms below the sand surface at low water mark can survive for long periods in the dark. (Jones-Wiscon-

W71-08039

COMPARISON OF TWO STORAGE METHODS FOR THE ANALYSIS OF NITROGEN AND PHOSPHORUS FRACTIONS IN ESTUARINE WATER.

Bureau of Commercial Fisheries, Beaufort, N.C. Center for Estuarine and Menhaden Research. For primary bibliographic entry see Field 05A.

HYDROLOGY OF THE YTHAN ESTUARY WITH REFERENCE TO DISTRIBUTION OF MAJOR NUTRIENTS AND DETRITUS, Aberdeen Univ., Newburgh (Scotland). Culterty

Field Station. J. H. Leech.

Journal of the Marine Biological Association of the United Kingdom, Vol 51, No 1, p 137-157, Feb 1971. 21 p, 12 fig, 14 tab, 19 ref.

Descriptors: *Estuaries, *Nutrients, *Water chemistry, Water balance, Tides, Mixing, Density stratification, Ecology, Saline water intrusion. Identifiers: Ythan Estuary (Scotland).

The Ythan estuary, a short shallow estuary in northeastern Scotland, was surveyed over a 2-year period to determine environmental characteristics and distribution of nutrients and organic carbon. The tide is the dominant environmental factor. Ratio of tidal prism volume to fresh water volume at mean high water is about 20:1. Flow ratios indicate that the estuary is well mixed. Flushing time for mean tides was calculated as 1.15 tidal periods. The horizontal salinity gradient varied seasonally and with tidal amplitude. Seasonal variations were related to rainfall and evaporation. Channel salinities near the mouth ranged from 1.7 parts per 1000 at low tide in spring to 34.2 parts per thousand at high tide in summer. The horizontal gradient in nutrient concentration was related to tidal incursion. Freshwater levels of inorganic phosphate were slightly higher than marine concentrations; amounts of nitrate and silicate in the fresh water were about an order of magnitude greater than in marine water. Fresh water supplies about 70% of the nitrate and 80% of the silicate which flows into the estuary; marine water contributes about 70% of the phosphate. Most of the organic matter entering the estuary with fresh water was detritus of terrestrial origin. The marine contribution of particulate carbon exceeded that of fresh water by an order of magnitude. (Knapp-USGS) W71-08062

DISTRIBUTION, COMPOSITION AND TRANSPORT OF SUSPENDED SEDIMENT IN REDONDO SUBMARINE CANYON AND VICINITY (CALIFORNIA),

University of Southern California, Los Angeles. Dept. of Geological Sciences.

For primary bibliographic entry see Field 02J. W71-08064

NEWPORT SUBMARINE CANYON, CALIFOR-NIA: AN EXAMPLE OF THE EFFECTS OF SHIFTING LOCI OF SAND SUPPLY UPON CANYON POSITION,

University of Southern California, Los Angeles. Dept. of Geological Sciences. For primary bibliographic entry see Field 02J. W71-08065

SAND WAVES IN THE NORTH SEA OFF THE COAST OF HOLLAND,

University of East Anglia, Norwich (England). School of Environmental Sciences.

For primary bibliographic entry see Field 02J. W71-08066

TRANSPORT OF BEDLOAD AS RIPPLES DUR-

ING AN EBB CURRENT, Washington Univ., Seattle. Dept. of Oceanography. For primary bibliographic entry see Field 02J.

NUTRIENT DATA ON SEDIMENT SAMPLES OF THE POTOMAC ESTUARY, 1966-1968, Environmental Protection Agency, Annapolis, Md.

Water Quality Office.

For primary bibliographic entry see Field 05A. W71-08078

IRON IN THE MULLICA RIVER AND IN

GREAT BAY, NEW JERSEY, Princeton Univ., N.J. Dept. of Geological and Geophysical Sciences

L. S. Coonley, Jr., E. B. Baker, and H. D. Holland. Chemical Geology, Vol 7, No 1, p 51-63, Jan 1971. 13 p, 3 fig, 4 tab, 9 ref. NSF Grant GA-985.

Descriptors: *Iron, *Water chemistry, *Bottom sediments, Pyrite, Solutes, Oxidation-reduction potential, Hydrogen ion concentration. Identifiers: *Mullica River (NJ).

The water of Mullica River, New Jersey, contains, on the average, several ppm iron. Mixing with ocean water in the lower reaches of the river and in Great Bay removes this iron as iron hydroxide flocs. Pyrite is formed in some of the sediments, but a search for other iron minerals in Great Bay was unsuccessful. It is likely that most of the precipitated iron hydroxide is swept out of Great Bay into the Atlantic Ocean by tidal currents. (Knapp-USGS) W71-08089

INTERNATIONAL, NATIONAL AND STATE ELEMENTS OF OCEANS AND COASTAL ZONE MANAGEMENT,

California Advisory Commission on Marine and Coastal Resources.

For primary bibliographic entry see Field 06E. W71-08158

FLORIDA MIDDLE GROUND,

Florida State Univ., Tallahassee. Dept. of Oceanography. H. W. Austin.

Marine Pollution Bulletin, Vol 1 (NS), No 11, p 171-172, Nov 1970. 1 fig, 1 ref.

Descriptors: *Gulf of Mexico, *Oceanography, *Bioindicators, *Analytical techniques, Biological properties, Chemical properties, Physical properties, Florida, Sea water, Hydrograph analysis, Estuaries.

Identifiers: *Florida Middle Ground, Transition zone, West Florida Shelf.

A comprehensive 18-month oceanographic study of the Florida Middle Ground is nearing completion by scientists of the Florida State University System. This Gulf of Mexico region is located on the outer edge of the West Florida Shelf between three water masses, the Gulf Loop Current, the west Florida estuarine waters, and the Florida Bay waters. It is a productive fisheries source and unique in biological, oceanographic and hydrographic respects. The research program consists of monthly survey cruises to collect biological, chemical and physical data. The useful role of indicator organisms in measuring short term changes in physical and chemical characteristics is described. Results so far are outlined, with the Middle Ground appearing as a transition zone between the three water masses. (McEntyre-PAI) W71-08159

Saline Water Conversion—Group 3A

COASTS OF FRANCE, GENERAL STUDY OF CHEMICAL POLLUTION DISCHARGED INTO THE SEA. INVENTORY AND STUDY OF TOXICITY, VOLUME III, ATLANTIC (IN FRENCH), Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France). For primary bibliographic entry see Field 05C. W71-08165

ENVIRONMENTAL FACTORS AFFECTING BAY AND ESTUARINE ECOSYSTEMS OF THE TEXAS COAST,

Coastal Ecosystems Management, Inc., Fort Worth, Tex.

For primary bibliographic entry see Field 05C.

DOCUMENTATION REPORT--FWQA DYNAM-

IC ESTUARY MODEL, Environmental Protection Agency, Washington, D.C. Water Quality Office.

For primary bibliographic entry see Field 05G.

03. WATER SUPPLY **AUGMENTATION** AND CONSERVATION

3A. Saline Water Conversion

HONEYCOMB THERMAL TRAP. New Mexico State Univ., University Park. For primary bibliographic entry see Field 07B. W71-07706

SALINE WATER CONVERSION PROGRAM--APPROPRIATION.

For primary bibliographic entry see Field 06E. W71-07714

RENOVATION OF MUNICIPAL WASTE WATER BY REVERSE OSMOSIS,

Environmental Protection Agency, Cincinnatti, Ohio. Environmental Research Lab. For primary bibliographic entry see Field 05D. W71-07756

DETERMINING THE FEASIBILITY OF OB-TAINING DRY BRINE EFFLUENTS FROM IN-LAND DESALTING PLANTS, Garrett Research and Development Co., Inc.,

LaVerne, Calif.

R. D. Ridley, S. Sack, R. N. Jacobson, and E. Chemtob.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$1.05. Office of Saline Water Research and Development Progress Report No 640, Oct 1970. 102 p, 27 fig, 15 tab, 14 ref, 3 append. OSW Contract 14-30-2661.

Descriptors: *Waste disposal, *Evaporators, Design criteria, Operating costs, Capital costs, *Brines, *Brine disposal, Waste water disposal, Desalination plants.
Identifiers: *Solar ponds.

Facility designs, capital costs, and annual expenses are presented for systems of disposal of brine effluents produced by desalination plants operating on brackish waters at inland locations in the western United States. The disposal systems reported on include: (1) solar ponds, and (2) multistage flash evaporators in conjunction with either conventional crystallizers or solar ponds. The brines considered were those that would result from desalination of four typical brackish waters found in the Western United States. Geographic applicability of the solar pond system is discussed and the results are displayed on a map of the area considered. A computer program, used to calculate

pond size from brine and climate variables, is also included. (Callahan-Office of Saline Water)

INVESTIGATION OF CELLULOSE ETHER ESTERS FOR REVERSE OSMOSIS MEM-BRANES.

Gulf South Research Inst., New Orleans, La J. K. Smith, E. Klein, F. Morton, and T. Casebonne For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$0.45. Office of Saline Water Research and Development Progress Report No 630, Dec 1970. 35 p, 8 ref. OSW Contract 14-01-

Descriptors: Reverse Osmosis, *Membranes, *Permselective membranes, *Semipermeable membranes, *Desalination, Saline water, Separation techniques, Membrane processes, Osmosis, *Membrane process

Identifiers: Ethyl cellulose, Cellulose ether esters, Cellulosic membranes, Solubility parameters.

The formation of asymmetric membranes from ethyl cellulose has been investigated, and the potential for their use in reverse osmosis evaluated. Previous investigators have shown that this cellu-lose derivative has water permeability and salt permeability properties which indicate that it should form highly rejecting membranes. In addition, ethyl cellulose polymers have hydrolytic sta-bility and mechanical resistance properties which compare favorably to cellulose acetate polymers. The first phase of this program examined the effects that the degree of substitution has on the physical and mechanical properties. It was demonstrated that the water content of the polymer films increased as the degree of substitution decreased and fewer hydroxyl groups of the glucose rings were etherified. Similar correlations were established for the relationships between D.S. of the polymer and initial moduli and ultimate tensile strength of the films derived from the polymer. A systematic approach to preparing asymmetric membranes has been employed, based on a detailed understanding of the solution properties of ethyl cellulose. The raw data were taken from the literature, manufacturers bulletins, and augmented by laboratory experiments. Solubility parameters were used to devise a hypothesis for solvent combination requirements which would yield ethyl cel-lulose solutions capable of forming asymmetric membranes. (Kindley-Office of Saline Water) W71-07832

PRACTICAL PROBLEMS IN COMBINING ELECTRIC POWER PRODUCTION WITH SEA WATER DESALINATION, San Diego Gas and Electric Co., Calif.

For primary bibliographic entry see Field 08C.

DEVELOPMENT OF IMPROVED CELLULOSE ACETATE MEMBRANES,

Hercules, Inc., Cumberland, Md. Allegany Bal-

Mark E. Cohen, Michael A. Grable, and Billy M.

Riggieman. For sale be the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$1.00. Office of Saline Water Research and Development Progress Report No 608, Sept 1970. 94 p, 26 fig, 29 tab. OSW Contract 14-30-2527.

Descriptors: *Desalination, *Membranes, Reverse osmosis, *Membrane processes, Osmosis. Identifiers: Hollow fibers, Tubules, Skinned mem-

branes, *Composite membranes, Cellulose esters, Ultrathin membranes, Membrane casting formula-

The objectives of this program were to develop improved hollow-fiber membranes for reverse osmosis and to evaluate the best membranes developed

in a bench-scale module. Both asymmetric and composite membranes were investigated. These studies produced a high performance asymmetric hollow-fiber membrane which operated successfully in modules with capacities up to 175 gpd. Substantial progress was also made toward preparing high-flux composite membranes. Composite membranes were prepared by directly coating cellulose nitrate shock gels with dilute chloroform solutions of cellulose triacetate and mixtures of cellulose triacetate and high-molecular-weight polyethylene glycols. The cellulose nitrate shock gels show outstanding promise as composite membrane sub-strates, being both highly porous and finely porous as well as exhibiting good mechanical properties. These composite membranes, in flat-sheet form, gave water flux rates approaching 20 gfd at a 90% sodium chloride rejection level, and 11 gfd at a 97% sodium chloride rejection level, when tested with a 0.5% sodium chloride feed brine at 1500 psi. Their performance in hollow fibers was lower, how-ever, because of the much lower permeability of the hollow-fiber shock-gelled substrates. A 0.13 gfd flux rate and a 99.0% sodium chloride rejection were obtained in a composite hollow-fiber membrane with a 0.5% sodium chloride feed brine at 600 psi. Improvements in the fabrication of the cellulose nitrate shock-gelled hollow-fiber substrates should allow preparation of very high-flux composite hollow-fiber membranes. (Horowitz-Office of Saline Water) W71-07834

REGENERATION OF CELLULOSE ACETATE

MEMBRANES, Aerojet-General Corp., El Monte, Calif. P. A. Cantor, W. S. Higley, and C. W. Saltonstall,

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$0.50. Office of Saline Water Research and Development Progress Report No 601, July 1970. 43 p, 8 fig, 10 tab, 1 ref. OSW Contract 14-01-0001-1815.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, Cellulose, Osmosis, Membrane processes, Acids

Identifiers: *Cellulose acetate, Acetic acid, Oxalic

Several simple methods for in situ one-step regeneration of both flux and salt-retention properties of service-deteriorated membranes have been developed. Membranes have been successfully regenerated using hot, 4% acetic acid, and a onestep cleaning method effective at room temperature has also been developed. A promising process which combines cleaning and regeneration in one step, using 1% oxalic acid with 3% acetic, was demonstrated. (Mintz-Office of Saline Water)

SEAWATER CORROSION TEST PROGRAM -SECOND REPORT, Dow Chemical Co., Freeport, Tex.

For primary bibliographic entry see Field 08G. W71-07975

INVESTIGATION OF GALVANICALLY IN-DUCED- HYDRIDING OF TITANIUM IN SALINE SOLUTIONS, Battelle Memorial Inst., Richland, Washington.

Pacific Northwest Labs. For primary bibliographic entry see Field 08G.

DEVELOPMENT OF A CALIBRATION MODULE FOR TRACE OXYGEN ANALYZERS, CALIBRATION Aerojet-General Corp., El Monte, Calif. For primary bibliographic entry see Field 08G.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

NEW TECHNOLOGY FOR TREATMENT OF WASTE WATER BY REVERSE OSMOSIS, Envirogenics Co., El Monte, Calif. For primary bibliographic entry see Field 05D.

REVERSE OSMOSIS-A REVIEW OF ITS APPLICATIONS TO WASTE TREATMENT,
Ontario Research Foundation, Sheridan Park.
For primary bibliographic entry see Field 05D.

W71-08006

3B. Water Yield Improvement

A METHOD FOR CHARACTERIZING THE RUNOFF POTENTIAL OF RAINFALL IN WATER HARVESTING SCHEMES, Hebrew Univ., Rehovoth. Faculty of Agriculture.

E. Rawitz, and D. Hillel.

Supported in part by US Dept of Agriculture, Soil and Water Conservation Div. Water Resources Research, Vol 7, No 2, p 401-405, Apr 1971. 5 p, 4 fig, 2 tab, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Arid lands, *Runoff forecasting, *Water yield, Water supply, Water balance, Data collections, Infiltra-tion, Rainfall disposition, Rainfall intensity, Storm

Identifiers: *Runoff potential, *Israel.

A method is presented for evaluating the runoff-producing potential of rainfall patterns and for estimating the amount of water hypothetically obtainable from water harvesting areas of given average in-filtration rates. Data obtained from the arid zone of Israel indicate that the distribution of rainfall amounts in relation to rainfall intensities is skewed toward the low intensities and that a few large storms generally account for most of the total rainfall and runoff producing potential. Scaling of rainfall intensity versus relative rainfall amount shows that seasons with widely different total rainfalls nevertheless have similar relative distribution patterns. This fact suggests the possibility of finding a function that can adequately characterize the relative intensity distribution pattern of a region and can be used to predict runoff potential in relation to seasonal rainfall probabilities. (Knapp-USGS) W71-07913

CLOUD-SEEDING EXPERIMENT, TASMANIA, 22 DECEMBER 1966 TO 26 FEBRUARY 1969, Commonwealth Scientific and Industrial Research

Organization, Sydney (Australia). Div. Radiophysics. E. J. Smith, and E. E. Adderley

Available from the National Technical Information Service as N70-43097, \$3.00 in paper copy, \$0.95 in microfiche. Commonwealth Scientific and Industrial Research Organization (CSIRO) 3rd Progress Report, Dec 1969, 102 p, 13 fig, 14 tab, 3

Descriptors: *Cloud seeding, *Rainfall, *Silver iodide, *Artificial precipitation, Aircraft, Reviews, Meteorological data, Clouds, Winds, Air masses, Atmosphere, Weather. Identifiers: *Australia (Tasmania).

A cloud seeding experiment conducted in Tasmania, Australia from December 1966 to February 1969 is described. Its main purposes were to determine the amount by which seeding clouds with silver iodide smoke released from an aircraft can increase precipitation in a hydroelectric catchment area, the circumstances in which the increases can be obtained and the duration of the effects. The seeding operation was carried out in alternate years only. On days when clouds are suitable for seeding, they are seeded in seeded periods but observed and not seeded in unseeded periods. Thus rainfall may be compared on two similar sets of suitable days, on one set of which clouds were seeded and the other not. No statistical bias is in-

volved. Similarly, rainfall on seeded days of a given type may be compared with rain on unseeded days of otherwise similar type. Rainfall totals and ratios on seeded and suitable days, together with subdivisions by cloud type and air mass are tabulated. In 1968 seeding was successful in frontal and cyclonic air masses and with stratiform and indeterminate clouds in the west and cumuliform clouds in the east. (Woodard-USGS)

USU TELEMETERING PRECIPITATION GAGE

NETWORK, Utah State Univ., Logan. Coll. of Engineering. For primary bibliographic entry see Field 02B. W71-08131

TELEMETRY SYSTEM MODIFICATIONS AND 1968-69 OPERATION,

Utah State Univ., Logan. Coll. of Engineering. For primary bibliographic entry see Field 02B.

3C. Use of Water of Impaired Quality

NATURAL LEACHING OF THE HIGHLY SALT AFFECTED SOILS OF WESTERN RAJASTHAN. Public Health Engineering Lab., Jodhpur (India); Indian Grassland and Fodder Research Inst., Ihansi (India); and Central Arid Zone Research Inst.,

Jodhpur (India). For primary bibliographic entry see Field 02G. W71-08071

A STUDY ON CHANGES IN QUALITY OF UNDERGROUND WATER, Tabela House, Kota (India). Agricultural Chemis-

try Section.

For primary bibliographic entry see Field 05B.

RECLAMATION OF SALINE-SODIC SOILS IN THE UPPER COLORADO RIVER BASIN,

Colorado State Univ., Experiment Station, Grand Junction.

W. Robinson.

Colorado State University Experiment Station, Bulletin 535S, Mar 1968. 19 p, 11 fig, 1 tab.

Descriptors: *Reclamation, *Crop production, *Soil-water-plant relationships, *Drainage practices, *Irrigation practices, Salts, Alkaline soils, Saline soils, Saline water, Colorado, Electrical conductance, Gravels, Aquifers, Sodium compounds, Calcium compounds, Magnesium compounds, Chlorides, Sulfides, Leaching, Pumping, Irrigation efficiency, Water table, Wheat, Corn (Field), Rehabilitation, Treatment, Soil amendments, Crop

Below-average yields in arid and semi-arid lands may be due to accumulation of soluble salts and akaline soils. Sodic soils commonly become abandoned. The irrigated Grand Valley of western Colorado has 20,000 acres of below-average crop production. The Mancos Shale, parent material for soil, contains highly saline groundwater-electrical conductivity of 9.0 mmhos/cm in the shallow gravel aquifer, and more than 100 mmhos/cm in saturated soil pastes. Sodium, calcium, and magnesium chlorides and sulfates accumulate and may be leached to reclaim soils by additional irrigation. Soil amendments and salt tolerance are discussed. Pump drainage lowers the water table to reclaim soils efficiently. Pumping at 250 to 300 gallons per minute after 15 months lowered the water table about 2 feet in 150 to 200 acres with significant wheat and corn production improvement. Over irrigation and pump drainage proved a successful rehabilitation method for saline-sodic soils in the Upper Colorado River Basin. A table shows effects of leaching treatments on soluble salt content and

exchangeable sodium percentages of soil. Eleven figures show general topography of study area, typical fields of reclaimed and abandoned land, leaching effects, conductivities, yields and crop response. (Popkin-Arizona)
W71-08146

BENEFICIAL USES OF WARM WATER DISCHARGES IN SURFACE WATERS, Texas A and M Univ., College Station. Dept. of Wildlife Science.

Kirk Strawn.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 143-156, 1971. 3 fig, 2 tab, 9 ref.

Descriptors: *Heated water, *Beneficial use, *Fish farming, *Thermal powerplants, Temperature, Cultures, Catfishes, Trout, Swimming, Productivi-

Identifiers: Food-conversion rates, Temperature choice tank.

Possible beneficial effects of heated surface water develop when water is too cold for optimum growth and food conversion rates of fishes during much of the year and assuming the ability of fishes to come to a more suitable temperature if the temperature becomes too high in the discharge vicinity. Temperature choice tank and food-conversion rate studies revealed that the best temperature for channel catfish is 29C. Power plants could also make chilled rivers fit for swimming or provide heated water as a refuge for fishes during cold weather. A ...))—ACRE RESERVOIR IN Texas supplying cooling water for a power plant could produce two crops of 2,000,000 pounds each worth a total of \$1,600,000 leaving the plant with a first year net profit of \$705,150 less interest and taxes. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08304

UTILIZING WASTE HEAT FOR URBAN SYSTEMS,

Westinghouse Corp., Philadelphia, Pa. Environmental Systems Dept. J. A. Nutant.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 417-423,

Descriptors: *Heated water, *Beneficial use, *Thermal powerplants, *Air conditioning, *Aeration, Condensers.

Identifiers: *Waste heat utilization, Greenhouses, Refrigerating systems.

Assuming a 1000 Mw design nuclear power plant Assuming a root with design machan power plant-providing electricity and heating and air condition-ing by extracting steam at 220F from the power plant to drive the lithiumbromide refrigerating system, a population of approximately 450,000 could be served. Another concept investigated was the use of the condenser discharge for an aeration system. The system suggested is the injection of pure oxygen into the river. Sewage plant-power combinations have also been taken under consideration. Waste heat could be utilized to de-ice and de-fog airports. Greenhouse heating would be an economical way to use waste heat. A 1000 Mw plant could heat 4.4 sq. miles of greenhouse. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08316

3E. Conservation in Industry

THE CARACAS WATER UTILITY: OVERALL APPRAISAL,

National Inst. of Sanitary Works (Venezuela); and Ministry of Public Works, Caracas (Venezuela). For primary bibliographic entry see Field 06C.

3F. Conservation in Agriculture

EFFECT OF WATER AVAILABILITY ON PHOTOSYNTHESIS OF PLANTS, Illinois Univ., Urbana. Water Resources Center.

J. S. Boyer.
Termination Report, Feb 1970. 13 p. OWRR Project A-028-ILL (2).

Descriptors: *Plant moisture, *Photosynthesis, Irrigation, Chloroplasts, Drought, *Irrigation efficiency, Corn, Soybeans, *Consumptive use.

Agriculture is the largest consumptive user of water in this country, but irrigation is generally planned with little knowledge of the need of the crop for water. A method is described for determining the moisture status of corn and soybeams and it apmoisture status of corn and soybeams and it appears that it may be constructed more economically than previously thought. The technique is based on pressure that it applied to individual leaves. It was studied in conjunction with measurements of photosynthesis which showed that it is possible to predict how photosynthesis is affected by drought with measurements using the instrument. In corn and soybeans, photosynthesis was affected when water was still relatively available to the crop and well before any signs of drought were visible. Therefore it is important to be able to meathe crop and well before any signs of drought were visible. Therefore it is important to be able to measure the moisture status of corn and soybeans for maximum yield. Chloroplasts were also isolated from leaves which had been desiccated to varying degrees in order to determine whether drought affects photosynthetic activity at the subcellular level. Inhibition of activity was found in both sunflower and pea chloroplasts as the leaves became desiccated. The inhibition occurred at desiccation levels which are common during drought. levels which are common during drought. W71-07703

HIGH PLAINS IRRIGATION AND TEXAS WATER PLAN,

Texas Technological Coll., Lubbock.
For primary bibliographic entry see Field 06D.

SHADING INVERTED PYRANOMETERS AND RADIATION REFLECTED FROM AN ALFALFA CROP, Nebraska Univ., Lincoln.

For primary bibliographic entry see Field 07B. W71-07812

THE GREAT SISAL SCHEME, Hunter College, New York City, Anthropology De-

Daniel R. Gross.

Natural History, Vol 80, No 3, p 48-55, Mar 1971. 10 fig, 1 tab.

Descriptors: *Semiarid climates, *Social impact, *Fiber crops, *Ecology, *Economic impact, Droughts, On-site investigations, History, Crop

Identifiers: *Northeastern Brazil, *Sisal, *Human

The sertao of northeastern Brazil is a semiarid thorn scrub region where crop and cattle production prevail. In drought years, agricultural production is minimal and large numbers of people must migrate out of the region. In most years, until recently, nutritional levels were reasonable adequate for the peasant laborer population, which grew beans, squash and manioc on their small land-holdings. Since 1951, sisal has become an increasingly involved the company of the ingly important crop, so that in the last decade an overwhelming percentage of small landholders had begun growing it. Sisal is a highly drought resistant plant whose broad leaf contains a cellulose core which may be twisted into twine and rope. Although easily cultivated, the plant requires high inputs of labor for weeding, without which a field becomes choked and unreclaimable. Between 1951 - 1962, world market prices were extremely high and the majority of peasants abandoned food crops for sisal. This resulted in a precipitous drop in food production and the region became a net food importer. A small group of prosperous entrepeneurs developed, who were involved in sisal processing or food shops. Since 1962, sisal prices have plummeted and small growers have had to abandon their fields and work for processors. On-site investiga-tions have shown that for the majority, nutritional levels have decreased. Progress has come to only a few, while most people have become more im-poverished. This illustrates the necessity for an ecological approach in all agricultural economic planning. (Casey-Arizona)
W71-07813

ONION SEED PRODUCTION IN YUMA COUN-

Agricultural Research Service, Tucson, Ariz. Don R. Howell, and G. D. Waller. Progressive Agriculture in Arizona, Vol 23, No 1, p 10-11, 16, Jan-Feb 1971. 3 fig.

Descriptors: *Onions, *Seeds, *Crop production, *Limiting factors, *Crop response, Arizona, California, Risks, Cultivation, Fertilization, California, Risks, Cultivation, Pertination, Nitrogen, Phosphate, Irrigation practices, Pre-treatment (Water), Plant growth regulators, Herbi-cides, Weed control, Pest control, Profit, Economic feasibility, Planting management, Field

Identifiers: *Seed production, *Crop failures, *Pollinators, Honey-bee colonies, Yuma County (Ariz).

'Short-day' onion seed production is most successful in areas with warm, sunny, squall-free days such as prevail at Yuma, Arizona, though even here seeds are high-risk crops. Under proper conditions, however, seed production in Yuma County can be a profitable operation. Seed cultivation methods are discussed in this investigation of crop failures in Yuma County in 1969 and 1970. Side dressing and water-run fertilization by nitrogen and phosphate follow planting, though preplanting fertilization is practiced. Pre-irrigation occurs during early fall, and winter irrigation in seed-to-seed fields is withheld to 'shock' seeds to bulb. Some irrigation of bulb-to-seed fields resumes in December and January. A spring irrigation delay increases growing rate. Herbicides are used to control weeds and pests. Honey bee colonies serve as pollinators. Specially adapted combines facilitate harvesting. Plant disease control during cool-wet years needs further study, as does more adequate pollination because of the preference for honey bees of desert plants having the same blooming period as the onion plants. (Popkin-Arizona) W71-07818

WHEAT IRRIGATION AFFECTS FLOUR

YIELD AND QUALITY, Arizona Univ., Tucson; and Arizona Agricultural Experiment Station, Tucson.

A. D. Day. Progressive Agriculture in Arizona, Vol 23, No 1, p 3, 16, Jan-Feb 1971, 1 tab.

Descriptors: *Wheat, *Irrigation effects, *Gains (Crops), *Feeds, *Crop production, Arizona, Proteins, Viscosity, Limiting factors, Crop response, Soil moisture, Moisture stress, Moisture

response, son moisture stress, moisture uptake, Mixing, Field crops.
Identifiers: *Flour production, *Flour quality,
*Milling, *Mixing curve peak, *Mixing curve area,
Baking, Gluten.

Wheat production, for grain used for milling or livestock feed, has increased in Arizona. Yield, protein, alkaline water retention capacity, viscosity, mixing curve peak and area were investigated to evaluate irrigation effects on milling and baking quality of flour. Large yield reductions occurred when water was withheld at jointing. Highest protein was produced when plants were water stressed. Highest alkaline water retention capacity was found when moisture was withheld at jointing. High flour viscosity and stronger gluten occurred when soil moisture was withheld. Water stress at dough stage required longer time to reach flour mixing curve peak. Moisture stress decreased mixing curve area significantly. Flour protein content variations produced proportional viscosity and mixing curve area changes. (Popkin-Arizona) W71-07819

WATER RESOURCES AND IRRIGATION DEVELOPMENT IN THE MIDDLE EAST, Keble Coll., Oxford (England). Dept. of Geog-

raphy. C. G. Smith.

Geography, Vol 55, No 249, p 407-425, Nov 1970. 8 fig. 1 tab. 21 ref.

Descriptors: *Water resources, *Water resource development, *Arid lands, *Regional analysis, *Irrigation programs, Dry farming, Geographical regions, Social aspects, Political aspects, Economic feasibility, Temperature, Seasonal, Rainfall, River basins, River flow, Soil moisture, Precipitation (Atmospheric), Competing uses.
Identifiers: *Middle East, *Mediterranean cli-

mates, *Potential evapotranspiration.

The Middle East is arbitrarily defined as Egypt and southwest Asia, excluding Afghanistan. Two types of climate occur in the area, arid and semiarid, which are undifferentiable in terms of human geography, and Mediterranean climate involving winter rainfall at relatively low temperatures. The latter type of climate permits some soil moisture storage, enabling extensive dryland farming. Everywhere else agriculture is practiced only in river basins where extensive irrigation is possible or in those rare regions of high rainfall. Today, the overwhelm-ing population majority lives in the irrigated areas. In the Mediterranean climatic areas, aridity increases southwards and eastwards, while precipitation increases with elevation. Rivers having their source regions within the Middle East have a high ratio of runoff to precipitation. Potential evapotranspiration data indicate that regions of an evaporranspiration data indicate that regions of annual water surplus are relatively rare. For the Middle East as a whole, 9% of the total land area is cultivated (25% of which is irrigated) and another 8% is potentially cultivatable. Water resource development must take place within rigid limitations and therefore has the greatest potential in river basins where potential crop productivity is the highest. where potential crop productivity is the highest Several major river irrigation projects are outlined: the Tigris and Euphrates, within Syria, Iraq and Turkey, the Jordan-Yarmuk, within Jordan and Israel and the Nile, within Egypt. It is shown that required capital is available and much can be done, but that political and social problems in the area present major obstacles to development. (Casey-Arizona) W71-07822

RETURNS FROM DRYLAND FARMING IN THE TRIANGLE,

Agricultural Experiment Station. Montana Bozeman. Dept. of Agricultural Economics and Rural Sociology.

M. E. Quenemoen, and Robert F. Bucher.

Montana Agricultural Experiment Station, Bulletin 626, Apr 1969. 40 p, 33 tab, 33 ref.

Descriptors: *Dry farming, *Return (Monetary), *Evaluation, *Economic efficiency, *Farm management, Salvage value, Assets, Montana, Economic prediction, Market value, Land resources, Income analysis, Employment opportunities, Wheat, Prices, Cost analysis, Profit, Harvesting, Budgeting, Constraints, Unit costs, Acreage, Analysis, Farm prices, Farm units.

Identifiers: Triangle Area (Mont), Great Falls (Mont), Havre (Mont), Shelby (Mont), Big Sandy

This study evaluates returns from dryland farming in the Great Fall, Havre and Shelby area of Montana to determine if they are adequate to pay going market prices for land and if they give operators returns equal to non-farm employment. Wheat is the principal crop. Cost returns are based on the

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Group 3F—Conservation in Agriculture

difference between aquisition (asset price plus cost of acquisition, or total cost to buyer) and salvage (asset price minus marketing cost, or net receipts to a seller) values. Factors which influence farm operation beside maximum profit are outlined. Farms are classified according to 4 harvesting sizes - 400, 900, 1500, and 2400 acres. Budgets are developed from 16 farms near Big Sandy, supplemented by agricultural engineering reports. Returns to operators, based on acquisition values, were -\$225, -\$292, -\$279, and \$3368 for the 400-, 900-, 1500-, and 2400-acre farms. Returns to operators, based on salvage values were \$1407, \$3118, \$5370, and \$11711 for the 400-, 900-, 1500-, and 2400-acre farms. Dry-land farming returns are particularly unfavorable to young farmers who have higher potential returns in non-farm employment. Internal pressures operating to favor returns on farm enlargement are (1) rapidly decreasing unit costs as farms increase toward 900 acres, (2) greater net income from larger acreage, and (3) excess machinery capacity on smaller farms. Appendixes describe and summarize farm budgets for the 4 acreage sizes. Thirty-three tables compare costs, returns, models, land and machin-ery values, and capital investments. (Popkin-Arizona) W71-07823

AGGREGATE SUPPLY RESPONSES FOR EASTERN COLORADO WHEAT FARMERS, Economic Research Service, Washington, D.C. Farm Production Economics Div.; and Colorado State Univ., Fort Collins. Dept. of Economics. Harry G. Sitler, and Melvin D. Skold.

Colorado State University Experiment Station, Technical Bulletin 104, Apr 1969. 55 p, 45 tab, 3

Descriptors: *Dry farming, *Limiting factors, *Soils, *Precipitation (Atmospheric), *Return (Monetary), Colorado, Wheat, Crop production, Harvesting, Pastures, Acreage, Farm management, Cost allocation, Labor, Capital, Livestock, Farm prices, Supply, Computer programs, Grains (Crops), Budgeting, Economic efficiency, Income.

Precipitation and soils are the most important factors limiting wheat production, the best adapted cash crop, in eastern Colorado. Average annual precipitation ranges from 13 to 19 inches. Nonirigated cropland soils are heavy or sandy. Wheat is adapted to this area because it can be produced under dryland conditions. Wheat cropland is about 6,857,050 acres. Eastern Colorado is divided into 5 adjustment areas based on (1) wheat percentage harvested, (2) wheat yield per planted acre, and (3) cropland to pasture ratio. Data on soil, precipitation, crop activities and yields, machinery costs, labor and capital availability, livestock activities, and prices were collected. Supply responses were developed from historical records and computer linear programming. Responses are discussed and compared as low, low-medium, medium, highmedium, and high feed grain prices. Supply responses were greatest for medium feed prices. Farmer response to price change depends on many factors. Crop and livestock enterprise budgets, developed for major precipitation zones, show costs and outputs. Tables and figures include wheat response curves, and economic data for the 5 adjustment areas. (Popkin-Arizona) W71-07827

AGRICULTURAL FLAMING FOR INSECT AND WEED CONTROL IN COLORADO, Colorado State Univ., Fort Collins. Dept. of

Agricultural Engineering.
Ralph W. Hansen, and Robert G. Simpson.

Colorado State University Experiment Station, Bulletin 538S, Dec 1969. 9 p, 3 tab, 7 fig, 3 ref.

Descriptors: *Insect control, *Weed control, *Lethal limit, *Water yield improvement, *Burning, Water conservation, Insects, Weeds, Colorado, Evaluation, Soil moisture, Alfalfa, Chlorinated hydrocarbon pesticides, Life cycles, Insect behavior, Crop production, Sugar beets, Irrigation ditches, Costs, Water utilization, Larvae, Ditch grass, Hazards, Breeding.

The effectiveness of flame treatment to control insects and weeds is evaluated at the Colorado State University Experiment Station. Weeds not only use soil moisture, but provide breeding grounds for insects which infest irrigated crops. Flaming treatment is an alternative to chlorinated hydrocarbons, which present health problems by residue. Life cycle and habits of weevil are discussed. Flaming brings weevils to lethal temperatures at 200 degrees F. Only limited success was achieved from 1964 to 1968. An extensive 1968 field study by alfalfa growers did not show flaming to be effective against weevils. Flaming controls weeds when heat application is adequate to rupture plant cells. Weed control was most effective during dry periods with no wind. Flaming on yield and sugar content of sugar beets was found to be an effective weed control. Flaming to control weeds along irrigation ditches is an established Colorado practice. Such control is possible at low cost with no residue danger, and good trash elimination. Water is used efficiently with less loss in clean ditches where weed seed distribution is reduced. Figures show extent of weevil infestation in the United States, adult and larvae weevils, pupation within cocoon, plot experiments and hooded flamer. Tables show effect of flaming on yield, weed content, protein content, sugar beet yield, sucrose content, and ditch flaming costs. Ditch flaming costs at Arkansas Valley Branch Station for single burning of 6-foot width from 1963 to 1967 ranged from \$5.46 to \$8.17 per mile. (Popkin-Arizona) W71-07828

RESOURCES, COSTS AND RETURNS ON CATTLE RANCHES IN THE MOUNTAIN AREAS OF COLORADO BY SIZE OF RANCH,

Colorado State Univ., Fort Collins. Dept. of

C. Alan Nelson, and Melvin D. Skold. Colorado State University Experiment Station, Technical Bulletin 101, Mar 1969, 45 p, 14 tab, 1

Descriptors: *Resources, *Costs, *Return (Monetary), *Cattle, *Range management, Mountains, Colorado, Ranges, Livestock, Evaluation, Analysis, Resource allocation, Economic efficiency, Irrigated land, Water management (Applied), Flood irrigation, Gross income, Operating costs, Resource development, Productivity. Identifiers: *Resource management, *Beef produc-

A 6-county mountainous area in Colorado was evaluated in terms of resources, costs and returns on cattle ranches by 40 interviews. About 85% of the ranchland is irrigated, and more than 90% of the ranches have irrigation. Livestock production of feeder calves is the predominant enterprise. where private and/or public rangeland provide summer feed, and irrigated meadows provide winter feed. Management and allocation of water on native hay meadows, generally by flood irrigation, is essential to proper range production. Five ranch sizes (74, 181, 254, 321, and 764 animal units) do not differ in productivity. Beef production, sales, and gross income are proportional to resources employed because of the extensive naresources employed because of the extensive nature of ranching. The 181-and 254-animal units spend less per pound of beef produced than the 74, 321, and 764 units. Cash costs are the largest costs. Productivity index, and production per unit of input has not increased as rapidly as the index of operating expense per production unit. None of the ranches analyzed are making economically adequate returns. Resource adjustment and management may increase ranch income. Detailed analyses of resources allotment will be considered in future studies. Fourteen tables summarize pertinent resource, cost and returns data. (Popkin-Arizona) W71-07829

THE ECONOMICS OF CROPPING SYSTEMS FOR WESTERN COLORADO, Economic Research Service, Washington, D.C.

Economic Research Service, Washington, D.C. Farm Production Economics Div. C. Kerry Gee, and C. W. Robinson.
Colorado State University Experiment Station, Bul-

letin 539S, Dec 1969. 34 p, 21 tab, 4 ref, 1 fig.

Descriptors: *Economic efficiency, *Evaluation, *Analysis, *Rotations, *Farm management, Colorado, Consumptive use, Irrigation practices, Crop production, Alfalfa, Com (Field), Grains (Crops), Sugar beets, Barley, Profit, Computer programs, Average prices, Farm prices, Risks, Labor, Capital costs, Budgeting, Pricing, Selectivity, Planning Income. ty, Planning, Income.

The economics of consumptive use and irrigationwater requirements are evaluated for cropping patterns in western Colorado. A cropping system consists of a single crop grown continuously or a combination of crops grown in sequence or rotation. A rotation consisting of alfalfa for 3 years followed by corn for grain, sugar beets and barley as a nurse crop is the most profitable rotation tested. Analysis is based on linear programming, using average prices. Profits were maximized on rotation scheme prices. Profits were maximized on rotation scheme when sugar beet prices were from \$14.13 and \$16.17 per ton, and when corn prices did not rise above \$2.74 per cwt. Combining crop and livestock enterprises frequently increases farm profits. Farm anagers should consider price risks, labor, capital investments, financial risks, livestock, and cropping patterns. Budgeted cropping systems, optimum cropping systems with and without livestock, changing prices, and cropping-system selection are discussed. A figure shows optimum rotations with various sugar beet and corn prices. Twenty-one tables show prices, assumptions, budgets, optimum enterprise combinations, and cost and production. (Popkin-Arizona) W71-07830

DRILLING TEST HOLES FOR IRRIGATION

For primary bibliographic entry see Field 04B. W71-07922

PROBLEMS PROBLEMS OF WATER SUPPLY FOR AGRICULTURAL OPERATIONS IN LOWER WEST BENGAL,

Calcutta Univ. (India). K. Bagchi, and R. Bhattacharyya. Indian Geohydrology, Vol 5, No 1, p 90-93, Dec 1969. 4 p, 1 tab, 4 ref.

Descriptors: *Water supply, *Floods, *Droughts, *Hydrologic data, *Planning, Water resources development, Water management (Applied), Data collections, Statistics, Precipitation (Atmospher-

Identifiers: *India, West Bengal (India).

An attempt is made to interpret the precipitation data of Lower West Bengal (india) for the last 60-70 years in terms of water availability and the periodicity of supply. A study of the actual rainfall for the period (1891 to 1950) reveals that for the region as a whole the chances of experiencing extremely heavy rainfall (above 1905 mm) is much less than its experiencing scanty rainfall. Except for the western part, the region is not only a lowland but also carries several channels which bring in water from regions lying outside the study area. Abnormalities caused by excess rainfall beyond the region, both simultaneously and in periods when the channels are full, may play havoc with the standing crops. (Knapp-USGS)
W71-08099

METEOROLOGY AND THE MIGRATION OF DESERT LOCUSTS: APPLICATIONS OF SYNOPTIC METEOROLOGY IN LOCUST CON-

TROL, World Meteorological Organization, Geneva (Switzerland). R. C. Rainey.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

World Meteorological Organization, Technical Note 54, WMO No 1388, TP 64, Anti-Locust Memoir 7, 1963. 109 p, 3 plates, 24 fig, 2 tab, 1 app, 631 ref.

Descriptors: *Arid lands, *Insects, *Meteorology, *Insect behavior, *Weather patterns, Insect control, Foreign countries, Meteorological data, Winds, Migration, Maps. Identifiers: *Desert locusts, *Africa, *Asia, *Crop

Desert locust crop destruction is still a serious problem in more than 30 countries of arid or semiarid Africa and southeast Asia. Huge amounts of plant material are consumed by migrating swarms, and many tons of dead locusts can be recovered by intensive airplane-spraying of a concentrated swarm. Displacement of swarms in relation to meteorological factors encountered in migration can aid in forecasting locust attacks. Movements of migrating locusts appear to be greatly influenced by lowlevel windfields which they encounter. Many detailed maps, graphs, and photographs show swarm movement, meteorological factors encoun-tered, orientation of individuals within swarms, and locations and times of egglaying in relation to the appearance of young swarms. (Yensen-Arizona) W71-08133

WATER IN THE DESERTS,

Utah State Univ., Logan. Coll. of Engineering. For primary bibliographic entry see Field 06B. W71-08134

ALTERNATIVE USES OF ARID REGIONS, Ministere du Developpment Industriel et Scien-tifique, Paris (France). Direction du Gaz et de l'Electricite

For primary bibliographic entry see Field 06D. W71-08135

AGRICULTURAL PRODUCTION IN IR-RIGATED AREAS, Utah State Univ., Logan.

Wynne Thorne.

Presented at an international conference, 'Arid Lands in a Changing World', Tucson, Arizona, June 1969. In: Arid Lands In Transition, Dregne, H E (ed), p 31-56, Pub No 90, AAAS, 1970. 5 tab, 17

Descriptors: *Agriculture, *Crop responses, *Irrigation programs, *Arid lands, *Economic aspects, Soil groups, Water resources development, Foreign lands, Irrigation practices, Irrigation ef-

Identifiers: *Developing nations.

Arid lands present many benefits to potential agricultural efforts. The limited leaching over time leaves most of these regions rich in nutrients, excepting N. The lack of precipitation facilitates a precisely timed, diversified irrigation agriculture since rainfall often disrupts farm operations. It is argued that while arid land development involves high costs, the traditional considerations of costbenefit analyses are inadequate criteria. Present data indicate that 22% of all potentially arable land in the world is in arid or semiarid climatic zones. Most of this involves desert and nonvolcanic brown soil groups. Of the 56 nations inventoried, an overall average of 14% of total arable land is irrigated. A weighted average of estimated develop-ment costs was 980 dollars per ha., with irrigation equipment adding 250 or more dollars per ha. The problems of irrigated agriculture are discussed for several selected arid regions. The western W.S. has been experiencing spiralling population increases which may greatly affect land uses, water consump-tion priorities and public land priorities. However, precise predictions are not yet possible. Problems of the Middle East, North Africa, West Pakistan, India and Australia are also discussed in some detail. The Indian practice of spreading available irrigation water as thinly as possible over extensive

croplands brings out the basic question of limited vs. adequate water application. While it is stressed that there is no universally applicable answer, much research indicated productivity/unit of land or labor is greater in intensive water use situations. A critical problem in developing nations is the layering of expensive irrigation investments over traditional farm management practices. Also, con-struction promoters have too long been a dominat-ing force in irrigation development. (Casey-W71-08137

ECONOMICS OF LAND AND WATER USE, New Mexico Univ., Albuquerque. Dept. of Economics. For primary bibliographic entry see Field 06B. W71-08138

OF CLIMATOLOGICAL RECORDS FOR RATIONAL PLANNING OF LIVESTOCK SHELTERS,

Department of Agriculture, Columbia, Mo. Livestock Engineering and Farm Structures Research Branch; and Environmental Science Services Administration, Columbia, Mo.

Leroy Hahn, and James D. McQuigg. Agricultural Meterology, Vol 7, No 2, p 131-141, Mar 1970. 5 fig, 5 tab, 12 ref.

Descriptors: *Livestock, *Meteorological data, *Farm management, *Model studies, *Forecasting, Optimization, Efficiencies, Economic prediction, Economic feasibility, Productivity, Structures. Identifiers: *Livestock shelters.

The most efficient relationships between livestock yield, weather, and climate, allow animals to maintain normal body temperature without decreased production or increased feed intake. Climatological records can be evaluated to determine the feasi bility of erecting livestock shelters. By a system of calculating the probability of the frequency of a certain weather event, and measuring that event's effects on production, the profitability of erecting shelters can be estimated. Weather records and probability values for sixteen United States stations are used as examples. The most extensive application of this system is in milk production of dairy cattle, but modification of the system for egg production is underway. (Yensen-Arizona) W71-08144

RECLAMATION OF SALINE-SODIC SOILS IN THE UPPER COLORADO RIVER BASIN,

Colorado State Univ., Experiment Station, Grand For primary bibliographic entry see Field 03C. W71-08146

EVALUATIONS OF GRASSES, LEGUMES, AND GRASS LEGUME MIXTURES FOR IRRIGATED PASTURES GRAZED BY SHEEP UNDER VARIOUS FERTILITY AND MANAGEMENT PRAC-TICES.

Agricultural Research Service, Flagstaff, Ariz. Crops Research Div.

F. B. Gomm.

Montana Agricultural Experiment Station, Bulletin 618, Feb 1969. 34 p, 21 tab, 14 fig, 14 ref. Experiment Station Project M.S. 826.

Descriptors: *Grasses, *Legumes, *Varieties, *Rotations, Pastures, Irrigated land, Grazing, Sheep, Fertility, Management, Montana, Crop response, Soil structure, Productivity, Erosion control, Performance, Soil properties, Environmental effects, Nitrogen, Return (Monetary), Carrying capacity, Weight, Crop production, Forages, Proteins, Phosphorous, Calcium, Alfalfa, Winter killing, Orchard grass.

Many irrigated croplands in Montana were converted to 206,000 acres of irrigated pasture from 1954 to 1961. Grazing rotation is an important

management policy to maintain soil structure and production, and control erosion. This report summarizes the performance of several grasses and legumes alone and in combination with sheep grazing in irrigated pasture: (1) Results from 3 years of ing in irrigated pasture: (1) Results from 3 years of grazing legumes, grasses and mixtures, (2) conclusions from 5 years simple and complex mixtures, (3) summary of grazing on a fertilized pasture, and (4) results of 3 year management studies on 3 pasture mixtures. Irrigated mixtures should consist of one grass and one legume, where selected species meet management needs, soil conditions, and other environmental characteristics. Nitrogen fertilization of grass pastures gives economical returns other environmental characteristics. Nitrogen tertilization of grass pastures gives economical returns in carrying capacity, weight gains, and herbage yields, though management practices influence pasture productivity. The reliability of animal-weight-change method of determining total digestible nutrients is questioned. Lambs use pastures more efficiently than yearling ewes for gains. Legume percentage and protein content of herbage decrease in older pastures. Alfalfa-grass pastures are susceptible to winter kill and may cause bloating. Birdsfoot trefoil and orchardgrass are excellent legume and forage. Tables and figures quantify these results. (Popkin-Arizona) W71-08147

PANHANDLE RESEARCH STATION PROGRESS REPORT - 1969, GOODWELL, OKLAHOMA.

Oklahoma State Univ., Goodwell. Agricultural Research.

Oklahoma State University Agricultural Research, Progress Report p-620, Sept 1969. 60p.

Descriptors: *Soil-water-plant relationships, *Irrigation practices, *Water management (Applied), *Crop response, *Dry farming, Oklahoma, Frost, Great Plains, Research and development, Varieoreal rights, Research and development, value-ties, Field crops, Forages, Fertility, Planting management, Plant populations, Wheat, Crop production, Sorghum, Grains (Crops), Soil moisture, Nitrogen, Barley, Grazing, Fertilizers, Ir-rigation efficiency, Climatic data, Field capacity,

Tigator Christell, Cannick Corn (Field).
Identifiers: *Progress reports, *Panhandle Agricultural Experiment Station, Semiarid lands, Green bug, Residue, Infestation, Buffalo grass, Row spacing, Multicrop patterns, Rye, Crop failure.

The Panhandle Agricultural Experiment Station, in the semiarid high plains (Great Plains) of Oklahoma, has 43 acres of land for irrigation and dryland research. Field crop varieties, forages, ferdivising testarch. Field error varieties, to lages, ter-tility, residue management, plant population, and water management are studied. A late Spring freeze lowered wheat yields, and green sorghum reduced grain production in 1968. Results of 22 1968-69 projects are presented. These include irrigation research on small grains wheat fertility, moisture and nitrogen in wheat, moisture and buffalograss sod, row spacing, and multicrop patterns. Ryes produce a greater yield than wheats or barley for grazing grains. Irrigated wheat can be nitrogen fertilized economically in the plains. Greatest water-use efficiency by wheat occurs with lowest moisture level. Long-term climatic conditions are reflected in soil-moisture regime. The 40-inch row spacing of irrigated sorghum made poor use of field capacity. A wheat crop failure can be expected one-third of the time regardless of the management system. Corn and grain sorghum can successfully be produced after irrigated wheat. Expanding agriculture in the high plains justifies this research. Most of the studies are continuing. (Popkin-Arizona) W71-08149

BREAKTHROUGH SOUGHT IN

SORGHUM PRODUCTION,
Nobraska Univ., Lincoln. Dept. of Sorghum
Physiology; and Agricultural Research Service,
Lincoln, Nebr. Jerry D. Eastin, and Grant I. Johnson.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

University of Nebraska, College of Agriculture and Home Economics, Quarterly, Vol 14, No 4, p 4-7, Winter 1968. 4 fig.

Descriptors: *Sorghum, *Crop production, *Plant growth regulators, *Environmental effects, *Limitgrown regulators, *Environmental effects, *Limiting factors, Grains (Crops), Nebraska, Photosynthesis, Translocation, Respiration, Crop response, Synthesis, Carbon dioxide, Light, Energy, Proteins, Efficiencies, Heat, Moisture stress, Instrumentation.

Grain sorghum is a commonly and economically important crop in Nebraska, and arid and semiarid lands. Economic and nutritious yields are the result of complex factors such as photosynthesis, translocation, respiration, and associated synthesis of grain storage products. Photosynthesis is the conversion of carbon dioxide and light energy to starch and protein. Photosynthesis efficiency is related to heat and moisture stress. Translocation is the migration of starch and protein to the head of the plant. Respiration and synthetic activities include energy production from stored protein and starch, and production of protein and starch from energy. Environmental stresses, such as heat and moisture extremes, require detailed investigation. Most plants have some tolerance to heat or drought, but not necessarily to both. Complex instrumentation is necessary to measure coordinated plant processes. Plant breeders would make rapid progress in increasing production if they knew the limiting factors, and their order of importance over various conditions. Such knowledge is the topic of future research. Figures show increases in Nebraska sorghum acreage and yield, radioactive isotope tagging of sorghum, and sorghum head. (Popkin-Arizona) W71-08151

RE-USING IRRIGATION RUNOFF,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering and Natural Resources.
P. E. Fischbach, H. D. Wittmuss, and J. F. Decker.

University of Nebraska, College of Agriculture and Home Economics, Quarterly, Vol 14, No 4, p 15-16, Winter 1968. 3 fig.

Descriptors: *Water reuse, *Runoff, *Irrigation practices, *Water conservation, *Water management (Applied), Reservoir storage, Rainfall, Nutrients, Irrigation efficiency, Furrows, Piping systems (Mechanical), Cost comparisons. Identifiers: Community risks, Underground pipe.

Irrigation runoff, which may constitute 20 to 40% of the water applied by conventional surface systems, can be saved by a re-use system which collects runoff at furrow ends, delivers it to the same or adjacent field from a small sump, dugout or reservoir. The storage reservoir is the heart of this system. Runoff from irrigation and rainfall can be salvaged this way. Re-using runoff would save water, labor and plant nutrients, and maintain high irrigation efficiency. Large furrows are more effectrigation efficiency. Large full lows are more effective than small ones. Underground pipes may be used to redistribute the salvaged water. The cost of re-use water is about \$4 per acre foot, which is equivalent to a 50-foot lift on an irrigation well. Reuse of runoff may reduce water costs, labor requirements, and community risks. Photographs show a sump, dugout, dam and pond for runoff reuse. (Popkin-Arizona) W71-08152

PASTURE IMPROVEMENT THROUGH EFFEC-TIVE WEED CONTROL,

Agricultural Research Service, Lincoln, Nebr. For primary bibliographic entry see Field 04A W71-08153

THE EFFECTS OF SALINITY STANDARDS ON IRRIGATED AGRICULTURE IN THE COLORADO RIVER BASIN, Federal Water Pollution Control Administration,

Boulder. Colorado River - Bonneville Basins Of-

For primary bibliographic entry see Field 05G. W71-08222

SALINITY CONTROL IN RETURN FLOW FROM IRRIGATED AREAS - A DEMONSTRA-

TION PROJECT,
Colorado State Univ., Fort Collins. Natural
Resources Center. For primary bibliographic entry see Field 05G. W71-08225

RURAL-AGRICULTURAL WATER SUPPLY

SYSTEMS: IRRIGATION,
Department of Agriculture, Washington, D.C.
Clifford Dickason, and Howard Hill.
In: Public Facility Needs, Washington, DC, 1966, p 125-136.

Descriptors: *Irrigation, *Water supply, *Investment, Costs, Lakes, Streams, Reservoir, Groundwater, Canals, Capital, Cost, Financing, Taxes, Government, Water resource development, Forecasting.
Identifiers: *Public facilities, Conveyance systems,

User charges.

A survey was made of irrigation water supply systems that are either public facilities or group facilities operated by various types of irrigation water organizations such as mutual irrigation organizations, commercial water suppliers, irrigation districts, the Bureau of Reclamation, the Bureau of Indian Affairs, and certain states and cities. The nature and composition of irrigation facilities is presented with a description of the facilities and a discussion of existing capital plant in the U.S. This includes growth, ownership proportions and current economic value of the facilities. Construction, operation, and maintenance costs are presented, together with user charges. The trend of capital outlays is cited by accounting for new investment in irrigation, proportions of capital outlay by organizations, and various means of financing. Finally, a projection is made, extending to 1975, of changes in irrigated acreage and development that accounts for both Federal and non-Federal investment in the development of the irrigation aspect of water resources. (See also W71-08281) (Murphy-Rutgers) W71-08288

04. WATER OUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

SPILLWAY AND SLUICES, ALLEGHENY DAM, ALLEGHENY RIVER, PENNSYLVANIA AND NEW YORK. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07801

FLOW CHARACTERISTICS IN FLOOD-CONTROL TUNNEL 10, FORT RANDALL DAM, MISSOURI RIVER, SOUTH DAKOTA. HYDRAULIC PROTOTYPE TESTS, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07802

STABILITY OF SOUTH JETTY SIUSLAW RIVER, OREGON, HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W71-07806

FLOOD CONTROL PLANNING IN ARIZONA, Corps of Engineers, Los Angeles District, Calif. Alan Chapman.

Proceedings, 14th Annual Arizona Watershed Symposium, Phoenix, Sept 23, 1970, p 20-24,

Descriptors: *Planning, *Flood control, *Arizona, *Land use, *Channel improvement, Non-structural alternatives, Flood plains, Flood plain zoning, Waterproofing, Water conservation, Geographical regions, Federal government, Inter-agency cooperation, Arid lands, Regional analysis, Vegetation, Economic feasibility, Cost-benefit analysis, Environmental effects.

Identifiers: *US Army Corps of Engineers.

Identifiers: *US Army Corps of Engineers.

The Army Corps of Engineers is described as a federal agency dedicated to improvement of national water resources. The Corps is aware of environmental problems associated with its projects and hopes to achieve balanced programs through cooperation with other involved federal, state and local agencies, surveys involving regional growth and future regional needs and studies of alternate approaches to given problems. A number of proposed and actual studies of Corps flood-control-planning work are described for Arizona. A study planning work are described for Arizona. A study of the Rillito Creek near the city of Tucson is outlined in detail. The creek and its tributaries constitute a flood plain which effects much of the groundwater recharge of the area. Although the area is sparsely populated, periodic floods cause much damage. A regional study involving vegetation, soils and local land use and population trends was undertaken in cooperation with local interests. The aim was to insure that environmental factors was included in the overall planning process. It were included in the overall planning process. It was concluded that only channel improvements to control a discharge of 24,000 cubic feet/sec., a flood frequency of once in 50 years, were economically feasible. At a public hearing in Tucson, June 1970, four alternative plans were presented: (1) No flood control project (2) a 12 mile earth-bottom channel with stone revetted banks (3) a 10 mile earth-bottom structural measures, a combination of zoning and water proofing (4) a 10 mile earth-bottom channel with stone-revetted banks combined with flood plain management. (Casey-Arizona) W71-07816

ASWAN DAM LOOSES A FLOOD OF PROBLEMS,

Claire Sterling. Life, Vol 70, No 5, p 46-46A, 12 Feb 1971.

Descriptors: *Dams, *River basins, *Salinization, *Silts, *Arid lands, Political aspects, Social aspects, Ecology, Hydroelectric power, Saline soils, Soil erosion, Fertility, Deltas.
Identifiers: *Egypt, *Aswan High Dam, *Nile River, *Developing nations.

For millenia, the Nile River has supported agriculture in the Nile Valley by its annual flooding cycle. The silts deposited by the floodwaters have maintained a high level of soil fertility and created the Nile Delta. Additionally, flood waters washed away salt accumulations resulting from agricultural activities. Since 1964, the Aswan High Dam has eliminated annual flooding by backing up water into Lake Nasser, and since 1967, it has been producing hydroeletric power. The aim of the dam has been to permit double-crop agriculture by canal irrigation, flood elimination and power ranal irrigation, flood elimination and power production. Since the dam began operation, soil salinity levels have risen ominously, increasing amounts of acreage need artificial fertilzer and erosion is eating at the Delta coastline, now exposed to the full force of marine currents. Bilharziasis, a debilitating disease caused by a parasite carried by water snails, has shot from 0% to 80% in areas of newly-built canals. Control of the snails was formerly effected by the dry periods after the floods, and the canals encourage the spread of snails. Because the fresher Nile waters no longer dilute Red Sea waters flowing into the eastern Mediter-ranean, marine ecologic upheaval has resulted, en-

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Control of Water on the Surface—Group 4A

dangering the fishing industry of the entire area. Although the government hoped to reclaim 1,300,000 acres, so far less than 300,000 acres have been reclaimed. Lake Nasser losses of water through underground seepage and evaporation are enormous. Because of the environmental damage it has created, the dam has greatly impoverished an already destitute nation. (Casey-Arizona) W71-07821

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.

Corps of Engineers, New York. North Atlantic Div.

Army Corps of Engineers Water Resources Development Report, Jan 1971. 72 p, 3 fig, 1 map,

Descriptors: *Water resources development, *New Jersey, *Projects, *Surface waters, Navigation, Flood control, Watershed management, Beach erowater supply, Water quality, Water utilization, Evaluation, Planning. Identifiers: *US Army Corps of Engineers.

This report provides information on the scope and progress of water resources development (navigation, flood control, basin development, beach erosion, and recreation) within the State of New Jersey by the United States Army Corps of Engineers. It describes briefly the Corps' role in planning and building these improvements and includes an explanation of the procedure for initiating and processing them. Information is given on the status of the various projects, whether the work is completed, is underway, or has not been started. Because the Civil Works' activities of the Corps of Engineers are organized by river basins rather than State boundaries the work in this State comes within the jurisdiction of more than one District. Project locations and the District boundaries are shown on a map. (Woodard-USGS)

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN DELAWARE.

Corps of Engineers, New York. North Atlantic Div.

Army Corps of Engineers Water Resources Development Report, Jan 1971. 36 p, 4 fig, 1 map,

Descriptors: *Water resources development, *Projects, *Surface waters, *Delaware, Navigation, Flood control, Watershed management, Beach erosion, Recreation, Evaluation, Planning, Water supply, Water quality.

This report provides information on the scope and progress of water resources development (navigation, flood control, basin development, beach erosion, and recreation) within the State of Delaware by the United States Army Corps of Engineers. It describes briefly the Corps' role in planning and building these improvements and includes an explanation of the procedure for initiating and processing them. Information is given on the status of the various projects, whether the work is completed, is underway, or has not been started. Because the Civil Works' activities of the Corps of Engineers are organized by river basins rather than State boundaries the work in this State comes within the jurisdiction of more than one District. Project location and the District boundaries are shown on a map. (Woodard-USGS)
W71-07925

FLOOD PLAIN INFORMATION, BAYOU METO AND TRIBUTARIES, JACKSONVILLE ARKANSAS.

Corps of Engineers, Vicksburg, Miss.

Army Corps of Engineers Flood Plain Report, Aug 1970, 37 p, 25 fig, 27 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Arkansas, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.

Identifiers: *Jacksonville (Ark), Standard Project Flood, Intermediate regional flood.

Flooding along Bayou Meto and its tributaries at Jacksonville, Arkansas and vicinity is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall runoff, historical flood heights and other technical data. The greatest flood known to have occurred in the vicinity of Jacksonville was in February 1969. However, the upper portion of the Bayou Meto Basin in the vicinity of the State Highway 5 Bridges across Bayou Meto and Kellogg Creek and above is subject to localized flash flooding and records show a lack of continuity with the ing and records show a lack of continuity with the more generalized flooding downstream. The max-imum flood height recorded at the State Highway 5 Bridge across Bayou Meto was in May 1954 with an elevation of 253 ft above mean sea level. The maximum flood height at the State Highway 161 Bridge across Bayou Meto, 6.9 miles downstream, was in February 1969 with an elevation of 244 ft. On Bayou Two Prairie, 1969 high water marks were recorded at elevation 249 ft at the Section Line Road Bridge at Mile 45.5 and further upstream at the Miscouri Bacific Bailton at 1975. the Missouri Pacific Railroad Bridge over Jack Bayou high water marks indicate a flood crest elevation of 251 ft. (Woodard-USGS) W71-07933

FLOOD PLAIN INFORMATION, MIDDLE FORK FORKED DEEP RIVER AND TRIBUTARIES, VICINITY OF HUMBOLDT, TENNESSEE. Corps of Engineers, Memphis, Tenn.

Army Corps of Engineers Flood Plain Report, Feb 1970. 45 p, 11 fig, 15 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.

Identifiers: *Humboldt (Tenn) area, Standard Project Flood, Intermediate regional flood.

Flooding in the Humboldt, Tennessee area along the Middle Fork Forked Deep River and its tributa-ries is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extend of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Durations of floods are relatively short on the streams in the vicinity of Humboldt. During the flood of January 1956 the middle Fork Forked Deer River rose to its crest stage in about two days at a maximum rate of rise of about 0.4 foot per hour and remained out of its banks for nine days. The overall ranges in stage on the tributary streams are less than those for the Middle Fork Forked Deer River, and these streams rise to their peak in only a few hours. (Woodard-USGS)

LONG-RANGE FORECASTS OF RUNOFF FROM MOUNTAIN RIVERS OF SIBERIA (RUS-SIAN: DOLGOSROCHNYYE PROGNOZY STOKA GORNYKH REK SIBIRI), A. A. Kharshan.

Gidrometeorologicheskiy Nauchno-Issledovatel'-skiy Tsentr SSSR Trudy, No 65; Leningrad, 1970. 210 p, 57 fig, 34 tab, 240 ref.

Descriptors: *Runoff forecasting, *Hydrologic data, *Water resources, *Runoff, *River forecasting, Base flow, Rainfall-runoff relationships, Discharge (Water), Snowmelt, Topography, Geomorphology, Hydroelectric plants, Reservoir storage, Seasonal, Inflow, Meteorological data, Hydrogeology, Hydrography, Precipitation (Atmospheric), River basins, Snow surveys.

Identifiers: *Siberia, *Mountain Meteorological satellites.

Methods for long-range forecasting of runoff from Siberian mountain rivers are based on a study of ru-noff in the Irtysh, Ob', Yenisey and Angara River basins. Principal aspects of runoff considered are volume of spring-summer high water, average monthly and maximum discharges of water in spring and summer, monthly and quarterly runoff during summer-fall and winter seasons. For rivers of the Altay, Western Sayan and western slope of Eastern Sayan, snowmelt is 65-70% of high water runoff and 45-50% of annual runoff, while rainfall runoff is 20-25% and 40-45%, respectively. For waters of the eastern slope of Eastern Sayan and the Lake Baykal basin, snowmelt is 50-60% of high water runoff and 25-30% of annual runoff, while rainfall runoff is 30-40% and 60-65%, respectively. rainfall runoff is 30-40% and 60-65%, respectively. Glacier runoff only plays an important role at the upper reaches of high-mountain rivers of the Altay. Steady groundwater flow for all rivers is 10-15% of annual runoff. Generally, the ratio between snowmelt and rainfall runoff becomes less favorable for forecasting spring and summer-fall flow as one proceeds eastward. For the first time methods were worked out for long-range forecasting of water in-flow to reservoirs of large hydroelectric power stations in Siberia, although formulation of runoff forecast methods for Siberian mountain rivers is complicated by lack of observations of snow cover, precipitation and other meteorological factors in mountains. (Josefson-USGS) W71-07946

HYDROLOGICAL FORECASTS AND MODERN COMPUTERS,

COMPUTERS,
Gidronteorologicheskii Nauchno-Inssledovatelsii
Tsentr, Moscow (USSR).
L. S. Kuchment, and Ye. P. Chemerenko.
Trans from Zemlya i Vselennaya, No 3. Foreign
Technology Div., Wright Patterson AFB, Machine
Transl FTD-MT-24-193-70. Available from National Technical Information Service as AD-716 942, \$3.00, paper copy, \$0.95 microfiche.

Descriptors: *Hydrology, *Forecasting, *Surface waters, *Mathematical models, *Computers, Meteorology, Data collections, Streamflow, Precipitation (Atmospheric), Hydrographs, Weather forecasting, Flood forecasting, Runoff forecasting.

Every year the Hydrometeorological Center USSR issues more than 100,000 hydrological forecasts and warnings. This center is in charge of scientific and methodological work in this field, makes forecasts and issues a hydrological bulletin containing information on the general status of rivers, lakes and reservoirs in different regions of the USSR. In the regional administrations of the Hydrometeorological Service there are forecasting bureaus which prepare and disseminate hydrological forecasts. Any further development of hydrological forecasts or improvement in the advance time of forecasts is dependent on the mathematical description of hydrological processes and the relationships between individual hydrometeorological elements. Until recently forecasts have been based on simple physical or statistical relationships, which are entirely in-adequate considering the complexity of the ele-ments involved. Soviet scientists have developed a physical theory of the development of hydrological processes which can serve as a good basis for constructing reliable mathematical models. (Woodard-USGS) W71-07948

COMPUTER SIMULATION OF CLINCH MOUNTAIN DRAINAGE NETWORKS,

IBM Thomas Watson Research Center, Yorktown Heights, N.Y

J. S. Smart, and V. L. Moruzzi. Available from National Technical Information Service, as AD-717 086, \$3.00 in paper copy, \$0.95 in microfiche. IBM Thomas J. Watson

Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

Research Center Technical Report No 1, July 1970. 29 p, 10 fig, 5 tab, 12 ref. Contract No N00014-70-C-0188 ONR, Task No NR 389-155.

Descriptors: *Drainage patterns (Geologic), *Natural streams, *Computer models, *Mountains, *Virginia, Tennessee, Topography, Hydrology, Geology, Lithification, Data collections, Runoff, Computer programs. Identifiers: *Drainage networks, Clinch Mountain

(Va and Tenn).

Clinch Mountain, in southwestern Virginia and northeastern Tennessee, is a long homoclinal ridge with a dip angle that varies along the strike. The base width and height both decrease with increasing dip, so that the mountain provides an excellent example of a system with uniform lithology and structure but varying structural parameters. ous properties of the stream networks on both the dip and scarp slopes were measured and analyzed as a function of dip angle. A random-walk headward-growth model of stream network development was used to simulate the Clinch Mountain network; the criterion for a successful simulation was that the simulated and actual networks should have statistical geometrical similarity. Satisfactory results were obtained if both the reduced width (product of width and drainage density), and the number of outlets per unit length were assigned as input parameters. (Woodard-USGS) W71-07952

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL I, SECTION A - SUMMARY, Wisconsin Univ., Madison. Water Resources

Center.

For primary bibliographic entry see Field 05G. W71-07972

THE 1963-64 LAKE MEAD SURVEY,

Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.

J. M. Lara, and J. I. Sanders.

Available from the National Technical Information Service as PB-197 510, \$3.00 in paper copy, \$0.95 in microfiche. Report REC-OCE-70-21, Aug 1970. 162 p, 52 fig, 16 tab.

Descriptors: *Reservoir surveys, *Reservoir silting, Aggradation, Core drilling, *Geodetic surveys, First order surveys, Land subsidence, *Gamma rays, Rebound, *Hydrographic surveys, Sounding, Photogrammetry, Thalweg, Topographic mapping, *Sedimentation, Fluvial hydraulics, Unit weight, Sediment transport, Sediment sampling, *Physical properties, Watersheds, Basins, Trap efficiency Identifiers: Reservoir capacity, Gamma probes, Arizona-Nevada, *Lake Mead.

The 1963-64 Lake Mead survey was run to compute the reservoir capacity. Results of the geodetic and hydrographic surveys and sediment sampling equipment are described. The geodetic survey showed Hoover Dam subsided an average of 118 mm since 1935. Sonic sounding, photogrammetry, and cross-sectional profiling methods were used to run the hydrographic survey. Reservoir area and capacity tables were generated using an electronic computer. The present lake capacity is 29,755,000 acre-ft and the reservoir surface area is 162,700 acres at elevation 1229 ft. 2,720,000 acre-ft of sediments accumulated in the lake since 1935. A unit weight of 60 lb/cu ft was determined representative of the deposited sediments. Samples were collected from the major basins with a piston core sampler. A gamma probe was used to measure in situ wet bulk densities. Special sampling with a drill rig was conducted in Pierce Basin representing the sediment accumulation in the delta area. The reservoir trap efficiency is judged to be 100%. W71-08051

A BASIC HYDROLOGIC FORECAST OF THE DISTRIBUTION OF RUNOFF FROM MOUNTAIN RIVERS DURING A GROWING SEASON (RUSSIAN: FONOVYY PROGNOZ RASPREDELENIYA STOKA GORNYKH REK V VEGETATSIONNYY PERIOD), MOSCOW State Univ. (USSR).

For primary bibliographic entry see Field 02E. W71-08100

EFFECT OF FLAT BOG DRAINAGE ON THE RUNOFF REGIME OF SPRING HIGH WATER AND SUMMER FLOODS (RUSSIAN: SUMMER AND SUMMER FLOODS (RUSSIAN: VLIYANIYE OSUSHENIYA NIZINNYKH BOLOT NA REZHIM STOKA VESENNEGO POLOVOD'YA I LETNIKH PAVODKOV), Ministry of Land Reclamation and Water Economics, Minsk (USSR).

V. F. Shebeko.

Meteorologiya i Gidrologiya, No 12, p 52-58, Dec

Descriptors: *Drainage effects, *Bogs, *Surface runoff, *Soils, Land reclamation, Wetlands, Base flow, Floods, Hydrogeology, Geomorphology, Saturated soils, Watersheds (Basins), Gaging stations, Soil physical properties, Storage capacity, Identifiers: *Belorussia, Rain floods, Maximum discharge.

The effect of flat bog drainage and reclamation on the maximum runoff of spring high water is examined from long-term data of 10 gaging stations on reclaimed and undrained bogs of the Belorussian SSR. The Wetlands cover a bog area of more than 300 square kilometers and have similar soil, hydrogeological and geomorphological characteristics. Analyses of the soils physical properties, hydrogeology and geomorphology show that runoff conditions prior to basin drainage are homogeneous for the entire bog area. Studies of spring highwater maxima indicate that spring high-water for-mation conditions for drained and reclaimed bogs are subject to maximum variability, with the storage capacity of peat soils, soil freezing, surface runoff and melt water infiltration conditions varying more than on undrained bogs. Long-term observations reveal that there is essentially no surface runoff from reclaimed bogs during the summer and fall. The influence of bog drainage and reclamation on maximum flood runoff is evidenced from a decrease in maximum discharge of flood water as the size of drained bog areas increases. Generally, bog drainage and reclamation have little effect on rain flood maxima. (Josefson-USGS)

THE WATER BALANCE AND ITS TRANSFORMATION IN THE USSR (RUSSIAN: VODNYY BALANS SSSR I YEGO PREOBRAZOVANIYE).

Moscow, 'Nauka' Publishing House, 1969. 337 p, 69 fig, 140 tab, 429 ref.

Descriptors: *Water balance, *Water resources, *Hydrologic cycle, *Meteorological data, *Stream-*Hydrologic cycle, *Meteorological data, *Stream-flow forecasting, Water conservation, Water utilization, Evaporation, Water supply, Water storage, Runoff, Forecasting, Soils, Rivers, Agronomic crops, Base flow, Precipitation (Atmospheric), Soil management, River basins, Identifiers: *USSR, Agricultural practices, Zonal auttoris, Personalization, Soil zones, Mountain re-

patterns, Regionalization, Soil zones, Mountain re-

A forecast method is given for examining the effects of agriculture and forest management on water balance and streamflow in the USSR, with estimates of management influence projected to the year 1980. Studies were conducted in districts near Moscow, in the southern Transvolga and, during the last few years, in the Kursk Oblast. To study the natural water balance, a new geographic method takes into account the rock and soil elements of the water cycle and establishes relationships between groundwater flow, surface runoff, and soil moisture content. The first section of the

three-part monograph is devoted to a study of zonal patterns of water balance and and to the use of the patterns of water balance and and to the use of the geographic method for studying water balance of mountain regions. Results of investigations of water balance transformations are discussed in terms of oalance transformations are discussed in terms of the influence of various agricultural practices in the Ukraine, Kazakhstan and Western Siberia. The concluding section examines problems of water balance control and the principles underlying rational use and conservation of the water resources of the USSR. (Josefson-USGS) W71.08104 W71-08104

THE CROSS-FLORIDA BARGE CANAL: A LES-SON IN ECOLOGY,

For primary bibliographic entry see Field 06G.

THE LAYOUT OF NEW NAVIGABLE WATER-

Administration des Ponts et Chausees, Paris (France).

For primary bibliographic entry see Field 08A. W71-08120

A STORM DRAINAGE AND OPEN SPACE MASTER PLAN FOR HAMILTON COUNTY,

Consoer, Townsend and Associates, Chicago, Ill.

Hamilton County Regional Planning Commission, Cincinnati, Ohio, Dec 1966. 77 p, 15 fig. HUD Urban Planning Project -- Ohio P-53.

Descriptors: *Flood control, *Drainage programs, *Flood protection, *Cost-benefit analysis, *Planning, Flood plain zoning, Floodproofing, Land use, Administration, Drainage practices, Storm runoff, Urbanization, Financing, Erosion control, Sedimentation, Ohio.

Identifiers: *Open space, Flood hazards, Flood prevention, Master plan.

A long-term strategy and conceptual plan was developed for providing storm drainage and open space in Hamilton County, Ohio. A complete inventory was made of all streams, culverts and bridges having tributary drainage areas greater than 300 acres. These are shown on maps in a separate appendix. The study develops a method separate appendix. The study develops a method for determining flood flows for the structures and streams, establishes the design flows, and presents findings of the adequacy of all structures and streams with suggestions for improvement thereof. Information is given on present and future flood hazards, erosion and siltation problems, and open space land needs. Also included are suggestions for subdivision regulations, legislative guidelines, and suggestions for financing and administering the improvement programs that are adopted. The study covers the main watercourses and their branches in the seven major drainage basins of Hamilton County and portions of the watersheds within the City of Cincinnati that drain into County streams. All major outlet channels within other incorporated areas in the County are also included. Recommendations are made for improving 49 public structures and 22.1 miles of streams. Estimated costs are summarized, by drainage basin, in a separate appendix. A section is included on benefit-cost relations in connection with expenditures of public funds for drainage and flood control. (Poertner) W71-08122

DRAINAGE AND FLOOD CONTROL BACKGROUND AND POLICY STUDY, SUM-MARY REPORT.

Nolte (George S.) and Associates, San Francisco. Calif.

Available from the National Technical Information Service as PB-196 840, \$3.00 in paper copy, \$0.95 in microfiche. San Diego County Comprehensive Planning Organization, California, May 1970. 20 p, 5 fig. HUD Project No Calif P-294 (G).

WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface—Group 4A

Descriptors: *Flood control, *Drainage practices, *Channel improvement, *Flood forecasting, *Computer programs, Land use, Drainage programs, Flood protection, Construction costs, Drainage engineering, Drainage systems, Storm runoff, Administration, Flood plain zoning, California, Planning, Synthetic hydrology, Urbanization. Identifiers: *San Diego County (Calif), Regional flood control organization, Channel improvement

A flood potential exists in many areas of San Diego County and additional flood hazards are anticipated because of continuing population increases. This summary report contains highlights of the findings and conclusions presented in Volumes I and II. The study identifies the drainage and flood control problems of the San Diego region and provides an up-to-date inventory of pertinent drainage and flood control information. The drainage and flood control information prepared in this study. and flood control information. The drainage and flood control information prepared in this study will be used as a basis for developing a regionwide plan and program. Volume I presents physical descriptions for eight major drainage basins; analyzes urban growth factors as a part of the drainage and flood control problem; and suggests seven possible alternative organizational arrangements for carrying out flood control work for the region. Volume II describes URB DRA COUNT, as computerized method for the systematic evaluation. computerized method for the systematic evaluation of urbanization's effects on design and costs of flood control facilities. It was developed for evaluating the effects of alternative land uses. Detailed information on the methodology, includ-ing its pilot application to the Los Coches Creek Watershed, are described in Volume II. Instructions for use and documentation of the computer programs are provided. (See also W71-08126 and W71-08127) (Poertner) W71-08125

POLICY CONTROL DRAINAGE AND FLOOD BACKGROUND AND POLI VOLUME 1,

Nolte (George S.) and Associates, San Francisco,

Available from the National Technical Information Service as PB-196 838, \$3.00 in paper copy, \$0.95 in microfiche. San Diego County Comprehensive Planning Organization, California, May 1970. 276 p, 15 fig, 18 tab, 216 ref. HUD Project No Calif P-294 (G).

Descriptors: *Drainage programs, *Flood control, *Administration, *Land use, *Drainage practices, Flood protection, Flood plain zoning, Watersheds (Basins), California, Drainage systems, Hydrology, Drainage engineering, Drainage effects, Storm drains, Storm runoff, Urbanization, Financing,

Identifiers: San Diego County, Regional flood control organization

Appraisals of drainage and flooding problems in San Diego County are presented. Current practices for providing drainage and flood prevention facili-ties and programs are described for each of the 108 local, state and federal agencies having such authority or responsibility in the San Diego region. Urban developments in the flood plains have caused the serious flood hazards that now exist. Population increases will amplify flood problems unless effective control of land-use is implemented. There is sufficient usable land in the region for projected urban needs without further encroachment on flood plains. The responsibility for rivers and streams, land use control in flood plains, and the development of protective facilities and programs is fragmented among many agencies. Seven alternative governmental organizational units are suggested for developing a coordinated regional approach needed to achieve effective solutions to flood problems. Detailed descriptions are included of the hydrology and other characteristics of the eight drainage basins in San Diego County. Also discussed are urban growth patterns, land uses in flood plains, implementation of flood control and drainage programs and financing methods. The

responsibilities and authority of each public agency identified with storm drainage and flood control are outlined. An extensive annotated bibliography of publications pertinent to flood control and drainage in San Diego County is included. (See also W71-08125) (Poertner) W71-08126

DRAINAGE AND FLOOD CONTROL BACKGROUND AND POLICY STUDY, VOLUME II, A COMPUTER METHODOLOGY FOR DETERMINING URBANIZATION'S DRAINAGE CONSEQUENCE.
Nolte (George S.) and Associates, San Francisco,

Available from the National Technical Information Service as PB-196 839, \$3.00 in paper copy, \$0.95 in microfiche. San Diego County Comprehensive Planning Organization, California, May 1970. 95 p, 6 fig, 7 tab, 3 ref. HUD Project No Calif P-294 (G).

Descriptors: *Flood control, *Land use, *Computer programs, *Channel improvement, *Flood forecasting, Urbanization, River forecasting, Construction costs, Hydraulic models, Hydrograph analysis, Stage-discharge relations, Streamflow forecasting, Surface runoff, Synthetic hydrology, Simulation analysis, Drainage engineering, Planning, California.

Identifiers: *San Diege County (Calif), Channel improvement costs.

The computer program URB DRA CONS (Urbanization's Drainage Consequence) developed in this study provides a methodology to test both long and short-range consequences of varying forms of urbanization within flood plains and areas contiguous to flood plains. With this tool, planners and engineers can investigate a variety of land-use patterns to determine their downstream consequences are the estimated cost of chungal improvements. in terms of the estimated cost of channel improvement for varying degrees of flood protection. URB DRA CONS has been tested, and it is now operational on the computer at San Diego County's Operation Center. The concepts involved in the development of the URB DRA CONS computer methodology are explained herein. Application of the methodology involves use of the County's IBM 1130 computer. The URB DRA CONS programs for use on this computer are listed in the appen-dixes of this report. The application of URB DRA CONS to the Los Coches Creek watershed is presented to serve as a specific example of the methodology. Finally, there is a discussion of program modifications, research gaps, and missing data which must be accounted for before the URB DRA CONS methodology can be directly applied to the complete development of a county-wide flood control master plan. (See also W71-08125)

PASTURE IMPROVEMENT THROUGH EFFEC-

PASTURE IMPROVEMENT THROUGH EFFECTIVE WEED CONTROL, Agricultural Research Service, Lincoln, Nebr. M. K. McCarty, and C. J. Scifres. University of Nebraska, College of Agriculture and Home Economics, Quarterly, Vol 14, No 4, p 23-26, Winter 1968. 5 tab, 4 fig.

Descriptors: *Cutting management, *Weed control, *Reclamation, *Pasture management, *Herbicides, Weedicides, Nebraska, Pastures, Weeds, Grasses, Legumes, Ranges, 2-4-D, Fertilization,

Overuse and mismanagement caused degeneration of many acres of pasture and rangeland in Nebraska. Undesirable weeds replace the desirable grasses and legumes which are weakened by overuse. Mowing, herbicides and resceding are evaluated as weed control tools for pasture management. Mowing is relatively ineffective. Good control is obtained on broadleaf weeds by 2.4-D ester, though some undesirable grasses such as prairie threeawn are difficult to control. Combination herbicides such as 2,4-D, picloram or dicamba with amitrole may control mixed broadleaf-prairie threeawn infestations. Fertilized grasses produce vigorous growth which resists weed infestation. Re-seeding is an effective restorarow crop for one or more years will kill most weeds. Selection of proper herbicide and reseeding specie is important for effective weed control. Tables show results of 9-, 8-, 6-, 3 and 2- year studies. Figures show effects of 2,4-D and picloram, structure of 2,4-D, picloram and dicamba, and a photograph of amitrole and picloram effectiveness. (Popkin-Arizona)

FLOOD PROTECTION AT CULVERT OUT-

LETS, Colorado State Univ., Fort Collins. D. B. Simmons, M. A. Stevens, and F. J. Watts. Available from the National Technical Information Service as PB-196 972, \$3.00 in paper copy, \$0.95 in microfiche. Wyoming State Highway Dept, Planning and Research Division Report, 1970. 213

Descriptors: *Flood routing, *Flood control, Flow, Flood protection, *Bridges, *Culverts, Riprap, Spillways, Outlet works, Drains, Abutments, Colorado, Testing.

Techniques for the design of stable rock-riprap protection in the vicinity of bridge crossings are computed from methods derived in other sources, and the properties are related to particle sizes for riprap protection of abutments and piers. Design steps for prototype bridge crossings are enumerated so that the hydraulic engineer may use this report as a design manual. An example of the design protection for a prototype bridge crossing is design protection for a prototype rough the suggested design procedures. Riprap-protected spill-through abutments were constructed in the hydraulic facilities at Colorado State University in order to test the validity of the suggested design procedures. The results of this research will become the standard for establishing crosion protection required at bridges. W71-08182

THE USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK

STATE, New York State Department of Environmental Conservation, Albany. Div. of Water Resources. For primary bibliographic entry see Field 08A. W71-08185

APPENDIXES TO THE USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK STATE,

New York State Department of Environmental Conservation, Albany. Div. of Water Resources. For primary bibliographic entry see Field 06A. W71-08186

FLOOD CONTROL RELEASE OPTIMIZATION USING METHODS FROM CALCULUS,

Colorado Univ., Denver.

William C. Hughes.

Journal of the Hydraulies Division, ASCE, Vol 97, No HY 5, p 691-704, May 1971. 14 p, 4 fig, 5 ref, 2 append.

Descriptors: *Optimization, *Mathematical modeling, *Flood control, *Reservoir operation, *Networks, *Costs, Flow, Storage, Flood routing, Time, Damages. Identifiers: Calculus.

A means for modeling the operation of a flood control reservoir as a minimization problem which yielded an optimum release schedule for a reservoir or network of reservoirs was presented. The

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

problem was formulated to use methods from calculus as a means for obtaining a minimum solution and could be altered to make use of mathematical programming techniques. The analysis was limited to the operation of a network of flood control reservoirs and assumed that decisions regarding size, location, scale of development, etc. were made. The solution involved discrete time increments and used Lagrange multipliers to minimize a loss or cost function which included both the future flood risk costs resulting from storage and direct downstream damage costs associated with the magnitude of reservoir releases. The cost function was developed along with two flow functions, derived from a reservoir routing equation and a channel routing equation, and storage for a single flood control reservoir, an etwork of flood control reservoirs in parallel, and a network of flood control reservoirs in series. A general solution of the problem was demonstrated both mathematically and graphically for the case of a single reservoir.
With more than one reservoir in the network minimization became increasingly difficult and solution of a system of polynomials was required to obtain the minimum cost release schedule. (Kriss-Cornell) W71-08192

SOME EFFICIENT DYNAMIC PROGRAMMING ALGORITHMS FOR THE OPTIMAL SEQUENCING AND SCHEDULING OF WATER SUPPLY PROJECTS,

Case Western Reserve Univ., Cleveland, Ohio. For primary bibliographic entry see Field 06A. W71-08193

OPERATING RULES FOR JOINT OPERATION OF RAW WATER SOURCES.

OF RAW WATER SOURCES, Wisconsin Univ., Madison. Dept. of Civil Engineering; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.

Erhard F. Joeres, Jon C. Liebman, and Charles S. ReVelle.

Water Resources Research, Vol 7, No 2, p 225-235, Apr 1971. 11 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Linear programming, *Simulation analysis, *Streamflow, *Water supply, *Optimization, *Costs, *Operations, Reservoirs, Water demand

Identifiers: Susquehanna River, Synthetic streamflow generation.

The techniques of linear programming, synthetic streamflow generation, and simulation were merged to derive operating rules for a multiple source water supply. The general approach was demonstrated for the Baltimore water supply; where upland reservoirs furnish water by gravity flow, and a backup supply delivers pumped water from the Susquehanna River. The objective was to find the optimal (least cost) set of release decisions for the reservoirs such that (1) demands were met a given percentage of the time; (2) shortages would not exceed a stated magnitude more than a given percentage of the time; (3) reservoir releases were within the capacities of either the withdrawal structure or the treatment plants; and (4) quantities of water pumped through the Susquehanna pipeline were within the capacity of the pipeline or treatment plant. Chance constrained linear programming was employed to select candidate operating policies under the given power rate schedule, which were subsequently tested by a simulation program for long-term performance. The linear programming (LP) problem was solved for four different demand levels for four different weighting factors for summer pumping and simulation runs were carried out. Results indicated that the overall system average monthly operating cost could be reduced by using the derived operating results while at the same time maintaining system performance levels. (Kriss-Cornell) W71-08195

OPTIMUM DESIGN OF INTERBASIN TUNNEL SYSTEMS,

Florida Univ., Gainesville. Dept. of Civil Engineering

ing.
B. A. Christensen, and Peter W. Bush.
Water Resources Bulletin, Vol 7, No 2, p 273-284,
Apr 1971. 10 p, 3 fig, 2 ref.

Descriptors: *Optimization, *Computer programs, *Reservoir operation, *Tunnel design, *Inter-basin transfers, *Costs, *Discharge (Water), Decision making, Constraints, Energy losses. Identifiers: Objective function.

A system involving an arbitrary number of subreservoirs discharging water by tunnel systems into a main reservoir was considered. All tunnels were flowing full and it was assumed that all elevations of water surfaces in the subreservoirs and discharges leaving these were known. An iterative differential-calculus method was developed for the determination of all tunnel sizes giving minimum total cost of the system using the total cost function as the objective function. The energy losses in the tunnels rather than individual tunnel diameters were chosen as decision variables and resulted in substantial simplification of the set of equations representing the constraints. In order to establish the objective function in terms of energy losses, discharges and expressions relating to energy loss to tunnel size was known in all tunnels. Influence of average construction cost per unit volume, tunnel roughness and cross-sectional shape was taken into consideration. The corresponding computer program for the general case was presented but the method may also be applied to pipe systems, open channel systems, or combined systems by introduction of proper cost functions for these conduits.
(Kriss-Cornell) W71-08198

OPERATION OF RESERVOIR IN INTEREST OF FLOOD CONTROL. Corps of Engineers, Washington, D.C.

Corps of Engineers, Washington, D.C. For primary bibliographic entry see Field 06E. W71-08240

A STOCHASTIC APPROACH TO THE DEVELOPMENT OF A REGULATION PLAN FOR THE GREAT LAKES,

Department of Energy, Mines and Resources, Ottawa (Ontario); and McGill Univ., Montrel (Quebec).

For primary bibliographic entry see Field 06B. W71-08267

APPLICATIONS OF MONTE-CARLO METHOD TO RESERVOIR DESIGN,

Institut fuer Wasserwirtschaft, Berlin (East Germany).

For primary bibliographic entry see Field 06A. W71-08268

REGIONAL AND RIVER BASIN WATER SUPPLY SYSTEMS.

Corps of Engineers, Washington, D.C.; Bureau of Reclamation, Washington, D.C.; and Soil Conservation Service, Washington, D.C.

In: Public Facility Needs, Washington, DC, 1966, p 95-104.

Descriptors: *Water supply, *River basin, *Reservoirs, *Dams, *Water resources development, Water storage, Flood control, Hydropower, Navigation, Irrigation, Recreation, Fisheries, Costs, Capital.

Identifiers: *Water Resources Planning Act, *Public facility, *Public works, User charges.

The current storage situation is described for municipal and industrial water supply purposes in reservoirs constructed by the Departments of the Army, Interior and Agriculture. Each facility described results from dams constructed for multiple-purpose control of the waters involved, encompassing flood control, hydro-electric power, navigational flow regulation, pollution control, irrigation, recreation, fisheries, and local water supply purposes. The article surveys the storage facilities built by the Army Engineers, the Reclamation Burcau and the Soil Conservation Service. Each of these is analyzed according to the nature and composition of the public work or facility, the costs and user charges, the trend of capital outlays, and the needs and prospective capital outlays. In response to the requirements of the Water Resources Planning Act of 1965, the article presents the water storage situation in a manner designed to suggest prudent plans for the future, facilitating economically feasible water resource development. (See also W71-08281) (Murphy-Rutgers) W71-08287

HUMAN RESPONSE TO FLOODS.

Victoria Univ. (British Columbia). For primary bibliographic entry see Field 06B. W71-08292

4B. Groundwater Management

DILUTION OF AN INDUSTRIAL WASTE EF-FLUENT WITH RIVER WATER IN THE VADOSE REGION DURING PIT RECHARGE, Arizona Water Resources Research Center, Tuc-

For primary bibliographic entry see Field 05D. W71-07817

THE ECONOMICS OF CROPPING SYSTEMS FOR WESTERN COLORADO, Service, Washington, D.C.

Economic Research Service, Washington, D.C Farm Production Economics Div. For primary bibliographic entry see Field 03F. W71-07830

OPTIMAL USE OF COUPLED LEAKY AQUIFERS,

New Mexico Inst. of Mining and Technology, Socorro.

Z. A. Saleem, and C. E. Jacob.

Water Resources Research, Vol 7, No 2, p 382-393, Apr 1971. 12 p, 5 fig, 4 tab, 27 ref. OWRR Project A-028-NMEX (1).

Descriptors: *Conjunctive use, *Aquifers, *Optimization, *Water utilization, *Dynamic programming, Mathematical models, Systems analysis, Irrigation water, Confined water, Artesian wells, New Mexico, Aquitards, Probability, Cost-benefit analysis, Consumptive use, Phreatophytes, Evapotranspiration.

Identifiers: *Roswell (N Mex).

Aquifers enclosed or confined by sediments that impede or retard the vertical movement of groundwater generally leak. A stochastic dynamic programing model for the optimal operation of a composite system of two coupled leaky aquifers and a surface water subsystem is formulated and applied to the Roswell basin in New Mexico. The optimal operating policies for the two coupled aquifers of the basin are influenced by the values added to the basin by different crops, by the amounts of water in storage in the two aquifers, by the discount factor, and by mutual leakage of the aquifers. Some of these factors tend to increase whereas others tend to decrease the operating policy. The resultant of all these factors determines the final operating decision rule. The magnitude and direction of leakage are determined by the relative storages in the aquifers. Coupled aquifer systems should be treated as single sources and considered only for conjunctive use. (Knapp-USGS) W71-07916

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Groundwater Management—Group 4B

GEOLOGY AND GROUNDWATER RESOURCES OF ELLSWORTH COUNTY, CEN-TRAL KANSAS, Kansas State Geological Survey, Lawrence

For primary bibliographic entry see Field 02F. W71-07920

DRILLING TEST HOLES FOR IRRIGATION WELLS

Ground Water Age, Vol 5, No 8, p 34-35, Apr 1971. 2 p, 3 photo.

Descriptors: *Irrigation wells, *Drill holes, *Drilling, *Drilling equipment, *Rotary drilling, Exploration, On-site investigations, Methodology, Geologic formations, Groundwater. Identifiers: *Test holes.

Accuracy of test holes can be affected by type of rig, geologic conditions or drilling technique of operator. Six things may be found from the drilling test; (1) possibilities for a successful well; (2) best location for the well; (3) depth from which a desired amount of water can be pumped most economically; (4) approximate yield and pumping level that can be expected from the completed well; (5) best place for screen in well and best length, diameter, type and slot opening size; (6) most favorable type gravel pack. Drilling techniques in various types of geologic formations are described. (Woodard-USGS)

GROUNDWATER FOR IRRIGATION NEAR LAKE EMILY, POPE COUNTY, WEST-CEN-TRAL MINNESOTA, Geological Survey, Washington, D.C. Wayne A. Van Voast.

For Sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price 25 cents. Geological Survey Water-Supply Paper 1899 - J, 1971. 28 p, 14 fig, 3 tab, 13

Descriptors: *Irrigation water, *Minnesota, *Groundwater, *Water resources development, *Glacial drift, Aquifers, Hydrogeology, Water yield, Transmissivity, Permeability, Water quality. Identifiers: *Pope County (Minn).

In the Lake Emily area, Minnesota, thickness of the glacial drift ranges from about 200 feet to more than 400 feet. Within the drift are sand and gravel aquifers, some of which can yield adequate water supplies for irrigation. Outwash, as much as 60 feet thick, liexx at the surface. Where the outwash has saturated thicknesses of more than 40 feet and transmissivities of more than 50,000 gallons per day per food locally in the northern and western parts of the area, the aquifer should yield more than 600 gallons per minute to wells. Water in the buried and surficial aquifers is mainly of a calcium magnesium bicarbonate type and is suitable for irrigation. Calculated and estimated sodium adsorption ratios and salinity and boron concentrations are within the limits recommended by the U. S. Department of Agriculture. (Knapp-USGS) W71-07923

SALINE GROUND-WATERS IN THE CARBONIFEROUS ROCKS OF THE ENGLISH EAST MIDLANDS IN RELATION TO THE GEOLOGY, Water Resources Board, Reading (England); and British Petroleum Co., Ltd., London (England). For primary bibliographic entry see Field 02F

WATER FROM THE DESERT'S BED.

Country Life, Vol 149, No 3849, p 612-614, Mar 18, 1971, 5 fig.

Descriptors: *Irrigation systems, *Water sources, *Subsurface waters, *Water supply, Arid lands. Identifiers: *Qanats, *Iran.

Ancient and modern dependence for irrigation and water supply of Iran's desert agriculture upon qanats, or underground water tunnels is reviewed. Some quants are as long as 25 miles and carry water from wells which are 250 feet deep. Quants are observable from afar as mounds of soil around ventilation shafts dug at intervals of 50 yards along the tunnels. The qanats also support a species of transparent, blind fish whose disappearance from a quant is supposed to presage its drying up. 1961 statistics show approximately 20,000 quants in use and supplying nearly one-third of the water needed for irrigation in Iran. Modern water demands for supporting Iran's cultivated lands, two-fifths of which is irrigated, will require supplementation Terheran which once obtained all its water from qanats, now takes over one half from the Amir Kabir reservoir. (Cowgill-OWRR) W71-08052

A STUDY ON CHANGES IN QUALITY OF UNDERGROUND WATER.

Tabela House, Kota (India). Agricultural Chemistry Section.

For primary bibliographic entry see Field 05B. W71-08073

RELATION OF FRACTURE TRACES, JOINTS, AND GROUNDWATER OCCURRENCE IN THE AREA OF THE BRYANTSVILLE QUADRANGLE, CENTRAL KENTUCKY, Kentucky Univ., Lexington. Dept. of Geology. For primary bibliographic entry see Field 02F. W71-08077

W71-08077

GEOLOGY AND GROUNDWATER CONDITIONS OF THE ALLUVIAL TRACT, EAST OF DURGAPUR, BURDWAN DISTRICT, WEST BENGAL - A PRELIMINARY STUDY, Geological Survey of India, Calcutta.

For primary bibliographic entry see Field 02F. W71-08098

DUNES ON THE PLAINS - THE SAND HILLS REGION OF NEBRASKA,

Geological Survey, Lincoln, Nebr. For primary bibliographic entry see Field 02F. W71-08112

A PRELIMINARY 'LEAST COST' STUDY OF FUTURE GROUNDWATER DEVELOPMENT IN NORTHEASTERN ILLINOIS,

Illinois State Water Survey, Urbana, Ill.
A. F. Moench, and A. P. Visocky.
State of Illinois Department of Registration and Education, Springfield, Circular 102, 1971, 19 p, 4 fig, 3 tab, 10 ref.

Descriptors: *Water management (Applied), *Water supply, *Water costs, *Cost analysis, *Aquifers, Water sources, Water demand, Pumping, Water purification, Water treatment, Municipal water, Water requirements, Costs, Illinois,

Lake Michigan, Simulation analysis. Identifiers: *Northeastern Illinois, *Groundwater

An estimate was made of the average cost of producing groundwater in northeastern Illinois and to treat it to make it comparable in quality with treated Lake Michigan water. A digital simulation model was used. The cost of raw and treated groundwater produced in quantities sufficient, in most cases, to meet the projected demand to 2020 was estimated for each township in the six-county area. Three sources of groundwater were considered: the shallow sand and gravel aquifers, the shallow dolomite aquifers, and the deep sandstone snainow doffinite adjusters, and the deep analysis aquifers. Unit costs of wells, pumps, and rehabilitation were obtained for each aquifer in each township. These included both amortized capital costs and operation-maintenance-repair costs (in 1970 dollars). The costs of storage and distribution to consumers were not considered. Results showed that raw water varied in cost from as little as 2 cents per 1000 gallons to as much as 14 cents per 1000 gallons depending upon the depth to the deep sandstone water. The unit cost of treated water varied from 22 to 53 cents per 1000 gallons, the lower costs applying to the largest users because of the economy of scale in treatment. Also because of this economy of scale, the cost of treated water tended to decrease with time; the cost of raw water increased with time. Fourteen townships were found to be deficient in groundwater in 2020, by a total of 147 million gallons per day, and will have to find alternative sources. (Poertner) W71-08123

RECLAMATION OF WASTE WATER FOR WELL INJECTION,
Los Angeles County Flood Control District, Calif.; and California Inst. of Tech., Pasadena. W. M. Keck Lab. of Environmental Health Engineering. For primary bibliographic entry see Field 05D. W71-08124

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS, Illinois State Water Survey, Urbana.

James P. Gibbs.

Illinois Department of Registration and Education, Springfield, Circular 104, 1971. 23 p, 11 fig, 4 ref.

Descriptors: *Water costs, *Costs analysis, *Water supply, *Water management (Applied), *Water wells, Wells, Domestic water, Water purification, Pumping, Shallow wells, Aquifers, Illinois, Ground-

water mining, Groundwater.
Identifiers: *Domestic well costs, *Water treatment costs.

Cost information is given for private residential groundwater supply systems in Illinois. Graphs can be used to make reasonably accurate cost predic-tions for different types and depths of water supply wells. A typical domestic well in Illinois may be expected to cost about \$575. Cost data for pumping systems equipped with 10-gpm submersible pumps show that the average cost of these systems is about \$585. The costs of treating water for domestic use also are summarized. Two graphs illustrate the monthly costs of softening and removing iron at varying monthly consumption rates and concentrations of hardness-forming minerals and iron. The monthly cost of continuous chlorination is calculated. Use of the data presented makes it possible to estimate the monthly costs of raw and treated water from a domestic groundwater supply. Two maps show the probable costs of domestic raw water supply systems from sand and gravel wells and bedrock wells throughout the state. For a typical installation and domestic use rate in Illinois, the monthly cost of raw water is about \$11.00, softened water \$15.40, softened treated for iron \$22.00, and softened water treated for iron and chlorinated \$25.00. Similar calculations for any type and depth of well, water quality, and treatment can be made from the information in this report. This material should provide adequate infor-mation for planning purposes and decision making in developing a desired domestic supply. (Poertner) W71-08129

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM, VOLUME V. MATHEMATICAL MODEL FOR GROUND-WATER.

Fresno County Planning Dept., Calif. For primary bibliographic entry see Field 06B. W71-08179

EVALUATION AND COMPARISON OF RED FORK SAND WATERFLOOD PROJECTS IN OKLAHOMA,

Bureau of Mines, Washington, D.C. Kenneth H. Johnston.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

Available from the National Technical Information Service as PB-197 105, \$3.00 in paper copy, \$0.95 in microfiche. Bureau of Mines Report of Investiga-tions 7465, 1970. 45 p.

Descriptors: *Injection wells, *Oil industry, *Oil reservoirs, Oklahoma, *Sandstones, Permeability,

Identifiers: *Oil recovery, *Water injection, Drill core analysis, Well completion fluids, Red Fork Sand, *Low permeability sandstone reservoirs.

Information on oil and water production, volume of water injected, core analyses, and well completion data was collected on 28 Red Fork sand waterflood data was collected on 28 Red Fork sand waterflood projects for comparison and evaluation of results. An average water injection efficiency of 35 percent, an average water-injected to oil-produced ratio of 16.8:1, and an average loss outside the flood pattern of approximately 45 percent of the injected fluid resulted in an oil recovery to January 1, 1969, of only 5.6 percent of the pore volume, or 9.1 percent of the initial stock-tank oil in place. The principle causes of poor oil recovery from these projects are the losses of large quantities of injection water from the flood patterns through oriented, natural fracture systems or zones of high permeability and excessive channeling of injection fluids from input wells to oil wells. For more efficient operation and a higher percentage of oil recovery from the Red Fork sand and other low-permeability-sand waterflood projects, directional orientation of both induced- and natural-fracture systems should be determined during early development. The success of a low-permeabilitysand waterflood project depends to a large extent upon the orientation of the injection wells with the fracture system. W71-08180

ELECTRIC ANALOG MODEL STUDY OF THE HYDROLOGY OF THE SAGINAW FORMATION IN THE LANSING, MICHIGAN AREA-

Michigan State Univ., Lansing. Dept. of Geology. Merlin L. Wheeler.

Mertin L. Wheeler. Available from the National Technical Information Service as PB-199 538, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report No 10, Institute of Water Research, Michigan State University, Dec 1970. 63 p, 24 fig, 4 tab, 5 ref. OWRR Project A-001-MICH (3).

Descriptors: *Analog models, *Groundwater movement, *Hydrologic properties, *Water supply, *Leakage, Piezometry, Data, Pumping. Identifiers: Steady-state analysis, Transient analysis, Saginaw formation.

An electric analog model was constructed to deal with the problem of groundwater withdrawal by many centralized supply systems from the Saginaw Formation, the primary source of water for domestic and industrial use in the Lansing, Michigan area, which has resulted in a large cone of depression which is expanding rapidly. The initial design of the model utilized data presently available. In order to determine the leakage rate, a steady-state, or equilibrium analysis of the model was initiated using actual conditions, thus eliminating all time-dependent variables from the hydrologic system. The model was then modified for transient analysis until the analog simulation of the decline in the piezometric surface for several periods agreed closely with actual declines. It was also necessary to make a detailed examination of the pumpage from the aquifer. Determination of the leakage that was occurring from the glacial drift, in units of gallons per day square mill per foot of head difference was also made. During the analysis of the model, significant facts were revealed about the hydrology of the Saginaw Formation. most specifically related to aquifer leakage, and was considered a predictive tool in the planning of future water resources development in the Lansing area. (Kriss-Cornell) W71-08184

4C. Effects on Water of Man's Non-Water Activities

URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD (DISCUSSION), Leonard H. Watkins, Franklin F. Snyder, Harvey

W. Duff, and George C. C. Hsieh.
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No
HY7, p 1625-1631, Jul 1970. 2 tab, 4 ref.

Descriptors: *Hydrographs, *Runoff coefficient, Evaluation, Runoff, Rational formula, Storm ru-

Identifiers: *RRL method, *Urban runoff.

The authors separately discuss aspects of the article included in a previous issue on an application of the Road Research Laboratory method (RRL) for synthesizing urban runoff hydrographs to conditions at three locations in the United States. Leonard Watkins describes the use of this method in Great Britain, concluding that the amounts of runoff found by the American authors agreed with experience in Great Britain. Frank Snyder discusses the theoretical applicability and other features of the RRL method, and he concludes that more analysis is needed in regard to the assumption of a constant runoff coefficient equal to the percentage of impervious area connected to a storm drainage system. He also states that the applicability of the RRL method to urban basins with pervious and unconnected impervious areas for infrequent design storms is limited. Harvey Duff and George Hsich compare the commonly-used rational method to the RRL method for predicting urban runoff. The RRL method seems to result in more accurate inflow predictions, but both methods predict runoff accurately. The rational method appears easier to use; and when the RRL method is tried, a shorter time increment is recommended. (See also W70-02467)
W71-07841

URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD (DISCUSSION),

D. Earl Jones.
J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY9, p 1879-1880, Sept 1970.

Descriptors: *Runoff forecasting, *Hydrographs, Methodology. Identifiers: *RRL method.

The writer states that the Road Research Laboratory method provides a basis for evaluation of potential drainage area responses without prior extensive collection of local urban streamflow records furnishing a simple rationale for estimating flow hydrographs. The RRL model seems advantageous from the standpoints of simplicity, ease of application, minimal data input requirements, and reasonable reliability of results in the common application range. (See also W70-02467) W71-07844

REAL-TIME COMPUTER CONTROL OF URBAN RUNOFF, (DISCUSSION), For primary bibliographic entry see Field 08B. W71-07845

INVESTIGATION OF A WATER SUPPLY NEAR ENCINO, NEW MEXICO, DURING THE STAR-MET TEST

Geological Survey, Albuquerque, N. Mex. J. A. Basler.

Geological Survey Open-file Report, Mar 1971. 15 p, 2 fig, 3 ref.

Descriptors: *Water levels, *Farm ponds, *Explosions, *New Mexico, Stock water, Surface waters, Testing, Water level fluctuations, Precipitation (Atmospheric), Instrumentation, Evaporat Consumptive use, Data collections, Evaluation. Identifiers: *Torrance County (N Mex). Evaporation,

The U.S. Air Force has made tests using conventional explosives at a site near Encino. Torrance County, New Mexico. The initial high-energy detonation test was made at the site on Oct. 3, 1968. Soon thereafter, the ranch owner expressed concern that the detonation may have adversely affected a nearby surface-water supply of two ponds used for watering stock, about 250 feet south of the test site. Measurements made immediately before and after a detonation test, Nov. 4, 1970, indicate that the water levels in the ponds were not affected by the detonation. The water-level declines observed during a period of several days after the detonation are regular in occurrence and are similar to declines observed for several days prior to the detonation. These declines are attributed to water losses caused by evaporation and stock watering. The relation of the volume of water in the watering. The relation of the volume of water in the ponds to gains from precipitation, and losses from evaporation and from stock watering supports the conclusion, indicated by water-level measurements, that the detonation caused no change in the water supply in the ponds. (Woodard-USGS) W71-07919

DESERTIFICATION VERSUS POTENTIAL FOR RECOVERY IN CIRCUM-SAHARAN TERRITO-

Cairo Univ., Giza (Egypt). Dept. of Botany.

Presented at an international conference, 'Arid Lands in a Changing World, Tucson, Arizona, June 1969. In: Arid Lands In Transition, Dregne, H E (ed), Pub No AAAS, p 123-142, 1970. 4 fig, 71

Descriptors: *Soil erosion, *Arid lands, *Land use, *Vegetation effects, Environmental effects, Water conservation, Soil conservation, Grazing, Land reclamation.

Identifiers: *Descrtification, *Sahara Descrt.

Descrification is the gradual spread of a descrt into adjoining semiarid lands through their deterioration. This involves processes of perennial plant cover reduction, floral impoverishment, soil ero-sion, mobile and sand dune formation and desert pavement establishment. The usual factors responsible for this process are livestock overgrazing, cereal cultivation, the cutting of woody species and other natural vegetation mismanagement problems. It is stressed that the dynamic equilibrium of vegetation cover in arid and semiarid lands combined with thin soils and low rainfall render these fragile ecosystems subject to large degenerative changes as a result of small disturbances. Progressive vegetational degeneration is described in the midland belt of the Sudan as a result the clearing of native vegetation for the exploitation gum arabic. Due to population pressures such ex-ploitation is common. A number of plant and water conservation projects designed to retard the desertification process are described and criticized. These include enclosure experiments, water reservoir construction, water redistribution systems and afforestation. So far, their effectiveness has been limited. The author calls for an end to destructive practices and an integrated 'rational' program of and recovery practices. (Casey-Arizona) W71-08136

05. WATER QUALITY MANAGEMENT AND **PROTECTION**

5A. Identification of Pollutants

GLENODININE, AN ICHTHYOTOXIC SUBSTANCE PRODUCED BY A DINOFLAGELLATE, PERIDINIUM POLONICUM, Tokyo Univ. (Japan). Lab. of Marine Biochemis-

For primary bibliographic entry see Field 05C.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

POSSIBLE METABOLITES OF DIELDRIN IN THE SAILFIN MOLLIE (POECILIA LATIPIN-

NA), Miami Univ., Fla. Inst. of Marine and Atmospheric

Charles E. Lane, Douglas B. Seba, and W. Lee

Proceedings of the Society for Experimental Biology and Medicine, Vol 133, No 4, p 1375-1377, Apr 1970. 2 fig, 12 ref. FWPCA Grant No 01326-01.

Descriptors: *Dieldrin, *Chlorinated hydrocarbon pesticides, *Pesticide residues, *Metabolism, *Fish physiology, Bioassay, Pesticides, Gas chromatog-raphy, Laboratory tests, Pesticide kinetics, Path of pollutants, Organic compounds, Fish, Fish toxins,

Identifiers: *Poecilia sp., Sailfin molly, Liver metabolism.

Third generation cultivated sailfin mollies (Poecilia latipinna) were exposed to 0.012 ppm dieldrin in seawater, and tissues were subsequently analyzed with gas chromatographic techniques. Two products, thought to be metabolites of dieldrin, were detected in extracts of the liver and of various organs. These substances were resistant to alkaline hydrolysis, more polar than dieldrin, and stable to at least 230 degrees (C/F not specified). The authors suggest that the compounds may be partially dechlorinated cyclo-diene fragments of diel-drin. (LeGore-Washington) W71-07734

CARBON ADSORPTION FOR RECOVERY OF ORGANIC PESTICIDES,

Charlet Pest Icides, Environmental Protection Agency, Cincinnatti, Ohio. Analytical Quality Control Lab. W. J. Eichelberger, and J. J. Lictenberg. Journal American Water Works Association, Vol 63, No 1, p 25-27, Jan 1971. 10 ref, 4 tab.

Descriptors: *Adsorption, Carbon, Organic compounds, Pollutant identification, *Analytical techniques, *Pesticides, Endrin, Organic pesti-

Identifiers: *Carbon adsorption methods (CAM).

Adsorption and desorption efficiencies of a great many organic compounds are not known yet. For this reason the use of CAM alone could not determine the concentration of endrin in the Mississippi river. A thorough description of the experiment and procedure used are presented. Results of analysis of the grade sample taken at the beginning and end of each sample run are tabulated. Analysis of the grab samples after passing through the carbon showed no pesticide contents above the detectable level. Some compounds disappeared from the water after 4 days while most of the chlorinated compounds were present in nearly the same con-centration. However, heptachlor, aldrin, DDE, and endosulphan showed significant loss. Seven out of ten organophosphorus compounds were somewhat diminished after 4 days. Two tables showing the recovery of the compounds by CAM are given. Those tables indicate that the CAM is a useful procedure for isolation and measurement of methoxychlor, lindane, endrin, dieldrin, and heptachlor epoxide. It also shows that CAM is not suitable for recovery of fention, methyl, parathion, malathion, ethion, trithion, and methyl trithion. (Rayaan-Texas) W71-07769

BOD AND COD ANALYSES ON PARAFFINIC HYDROCARBONS,

University of Western Ontario, London. Biochemi-

J. Zajic, O. Spacek, and V. Strizic.

Journal, American Water Works Association, Vol 62, No 12, p 784-786, Dec 1970.

Descriptors: *Biochemical oxygen demand, *Chemical oxygen demand, *Analytical techniques, Kinetics, Design criteria, Mixing, Temperature, Oxidation, Incubation.

Identifiers: *Standard methods, *Manometric techniques, Hydrocarbons, Theoretical oxygen demand, BOD 5.

BOD and COD analyses on paraffinic hydrocarbons have long given erroneous results because of separation of the oils from the sample, and the subsequent incomplete oxidation. Hydrocarbons analyzed, including n-Hexane, n-Heptane, n-Decane, n-Dodecane, n-Hexadecane, n-Heptadecane, by the APHA standard BOD and COD analyses yielded values for COD of less than 5.5% of the Theoretical Oxygen Demand (TOD), of the amount of oxygen need to completely oxidize each hydrocarbon to CO2 and H2O. For BOD, the highest analysis was 2.2% of the TOD. Strict observance of the following precautions is required for BOD analyses on straight chain hydrocarbons: (1) pipettes must be chemically clean, and constructed such that oil will not stick to the surface, (2) oils present must not be allowed to separate BOD and COD analyses on paraffinic hydrocar-(2) oils present must not be allowed to separate from aqueous phase; (3) continuous stirring of the BOD bottle during the 5-day test should be practiced if at all possible. The Standard Methods 5-day BOD test has validity for hydrocarbon wastes only if these precautions are strictly observed. At the present time, COD analyses cannot be applied to hydrocarbon wastes, and COD data should be discarded in favor of BOD data obtained in the prescribed manner. (Lowry-Texas) W71-07772

DEVELOPMENT OF INSTRUMENTAL TECHNIQUES FOR THE ANALYSIS OF TRACE ORGANIC CONSTITUENTS IN WATER,

Connecticut Univ., Storrs. Ralph P. Collins.

Completion Report, July 15, 1970. 3 p. OWRR Project A-022-CONN (2).

Descriptors: *Gas chromatography, *Analytical techniques, Chromotography, Infrared, Mass spectrometry, *Freeze drying.
Identifiers: Geosmin, Trace organic constituents, *Streptomyces odorifer.

This project was concerned with the development of effective means of isolating, concentrating, identifying, and automating measurements of trace organic constituents in public water supplies. The trace organic constituents were removed from aqueous solution by freeze drying. This procedure avoids chemical, biological, or physical transforma-tions which are inherent in most other methods. The concentrated material is extracted in a liquidliquid extractor for approximately 72 hours. The petroleum-ether extract is dried, carefully, concentrated, and the concentrated extract is then subjected to gas-liquid chromatography. Infrared spectra and moss spectra were also obtained. Utilizing the procedure developed, earthy-musty odor constituents produced by Streptomyces odorifer were identified; these are trans-1, 10-dimethyl-trans-9bornane. A third important carthy-musty odor compound has not as yet been identified.

SPECTROPHOMETRIC DETERMINATION OF SMALL QUANTITIES OF PHENOLS, (IN RUS-

Moscow State Univ. (USSR).
A. P. Terentiev, S. I. Obtemperanskaya, and Yu. N. Tikhonov.

English summary. Zhurnal Analiticheskoi Khimii, Vol 25, No 9, p 1815-1818, 1967. 1 fig, 1 tab, 11

Descriptors: *Oxides, *Phenols, *Spectrophometry, Colorimetry, Analysis, Analytical techniques.

Identifiers: Naphthals, Heterocyclic oxy-com-

The introduced spectrophotometric method of determination of oxy-groups in phenols, naphthols and some heterocyclic oxy-compounds is based on

the colorimetric reaction of Janovsky. Essentially, the analysis consists of an extraction of 2-4 dinitrophenyl ethers with benzol and addition of acetone and tetramethyl ammonium hydroxide. The dependability of the method was verified by analyses of 26 phenols, including some pharmaceutical compounds. Positive results were not obtained with phenols vulnerable to quinone formations and phenois vulnerable to quinone formations and phenois containing strong electron accepting groups or dinitro-derivatives insufficiently soluble in organic solvents. (Wilde-Wisconsin) W71-07876

INSTRUMENTATION FOR MEASURING PHYSICAL PROPERTIES OF A LAKE, Cornell Aeronautical Lab., Inc., Buffalo, N.Y

For primary bibliographic entry see Field 02H. W71-07882

ACTIVATION ANALYSIS BY CHARGED PAR-TICLES (IN SLOVAK), Slovak Technical Univ., Bratislava (C-zechoslovakia); and Magyar Tudomanyos Akademia Kozponti Fizikai Kutoto Intezete, Bu-

For primary bibliographic entry see Field 07B. W71-07886

ON OPTIMUM CONDITIONS FOR ULTRASONIC SEPARATION OF DIATOMS OF SANDY BENTHOS (IN FRENCH), Centre d'Occanographie, Marseille (France). Station Marine d'Endoume.

For primary bibliographic entry see Field 07B. W71-07892

STREAM POLLUTION EXAMINATION BY BIOLOGICAL TESTS, Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia).

Dragica Matulova.

Preprint, Fourth International Conference on Water Pollution Research. Prague, Section 3, Paper 2, p 1-11, 2-6 Sept 196h 5 fig, 1 tab, 22 ref.

Descriptors: *Water pollution examination, *Biological tests, *Streams, Experimental procedures, Bioassay, Toxicity. Identifiers: *A-Z procedure, *Chlamydomonas, *The Biomass Titre (BMT).

Biological methods for classifying different water pollution levels in streams can be divided into ecological and physiological techniques. The physiological methods, which also include methods for estimation of the toxicity, utilize two main procedures, namely: (1) the exposure of natural populations living in the water under examination, in the same water or in different dilutions of toxic substances; and (2) the exposure of suitable test organisms in the water under examination after ganisms in the water under examination after removal of the original population. Three methods were described: the A-Z procedure, the biomass titre (BMT), and bioassay with Chlamydomonas. The advantages and disadvantages of each were discussed. (Wahtola-Washington) W71-07895

THE EFFECTS OF VARYING CONCENTRA-TIONS OF NUTRIENTS, CHLORINITY, AND DISSOLVED OXYGEN ON POLYCHAETOUS ANNELIDS,

California State Coll., Long Beach. Dept. of Biolo-

gy. For primary bibliographic entry see Field 05C. W71-07899

STEAM FILM SAMPLING OF WATER FOR MASS SPECTROMETRIC ANALYSIS OF THE DEUTERIUM CONTENT, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.; and Atomic Energy of Canada Ltd., Chalk River (Ontario). General Chemistry Branch.

Group 5A-Identification of Pollutants

For primary bibliographic entry see Field 02K, W*1-07918

SENSING OF LUMINESCENT MATERIALS.

Geological Survey, Washington, D.C.; and Perkin-

Elmer Corp., Norwalk, Conn. For primary bibliographic entry see Field 07B.

DIRECT DETERMINATION OF THE ELECTROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 10 TO THE 8TH POWER TO 4 x 10 TO THE 9TH POWER

Honolulu. Water Resources Univ... Hawaii

For primary bibliographic entry see Field 07B. W71-07974

DEVELOPMENT OF A CALIBRATION MODULE FOR TRACE OXYGEN ANALYZERS, Acrojet-General Corp., El Monte, Calif. For primary bibliographic entry see Field 08G. W71-07977

CONCENTRATION OF STRONTIUM-85 AND CESIUM-137 FROM WATER SOLUTIONS BY CLADOPHORA AND PITHOPHORA,

Alabama Univ., University. Dept. of Biology Louis G. Williams.

Journal of Phycology, Vol 6, No 3, p 314-316, 1970. I tab. 4 ref.

Descriptors: *Radioisotopes, *Algae, *Absorption, Monitoring, Analytical techniques, Laboratory tests, Cesium, Strontium radioisotopes, Ions, Rivers, Cultures, Organic matter, Bacteria, Water

Identifiers: *Cladophora glomerata, *Pithophora ocdogonia.

With the use of packaged live and preserved green algae and other organic materials, radionuclides in natural waterways, not found by the usual methods of analysis of raw water can be detected. Live algae concentrate cesium and strontium ions much more than ion-exchange resins or dead materials. This is significant in the ecology of food webs where radionuclides may be passed on to higher trophic levels. The concentration factors of nonliving organic materials were much lower and varied with the material, not with the calcium/potassium ratio. The effect of high calcium ions and high potassium ions was to lower the uptake of cesium more than strontium. Cladophora and Pithophora were grown im aquaria, packaged live in perforated polyethylene bags and tied submerged in various rivers for periods of 2 to 7 days, after which the contents showed high concentrations of many fission products, including strontium and cesium. Where aquatic environments are unfavorable for live Pithophora or Cladophora, these algae, fixed with merthiolate-iodine preservative, have been shown to be about twice as effective as mixed ion-exchange resins. (Jones-Wisconsin) W71-08032

COMPARISON OF TWO STORAGE METHODS FOR THE ANALYSIS OF NITROGEN AND PHOSPHORUS FRACTIONS IN ESTUARINE WATER.

Bureau of Commercial Fisheries, Beaufort, N.C. Center for Estuarine and Menhaden Research. Gordon W. Thayer.

Available from the National Technical Information Service as COM 71-00206, \$3.00 in paper copy, \$0.95 in microfiche. Chesapeake Science Vol No 3, p 155-158, Sept 1970. 2 tab, 11 ref.

Identifiers: *Nutrients, Storage, *Water analysis, Nutrients, *Estuaries, Water analysis, Refrigerating, Freezing, Phosphates, Nitrates, Ammonia, Quantitative analysis.

The change, during storage, in concentration of dissolved inorganic, dissolved organic, and particu-late phosphorus, and nitrate, nitrite, and ammonia in estuarine water was examined in samples that were refrigerated and in samples which were quickfrozen. One half of each set of samples was pretreated with 0.7% v/v chloroform. At all times of the year quick-freezing alone stabilized nutrient concentrations, whereas freezing with chloroform resulted, at times, in significant changes in the nutrient levels. Refrigeration never stabilized all nutrient levels regardless of the presence or ence of chloroform. W71-08050

NUTRIENT DATA ON SEDIMENT SAMPLES OF THE POTOMAC ESTUARY, 1966-1968,

Environmental Protection Agency, Annapolis, Md. Water Quality Office.

James W. Marks, and Orterio Villa, Jr.
Chesapeake Technical Support Laboratory Data Report No 11, 1970. 20 p, append.

Descriptors: *Nutrients, *Bottom sediments, *River beds, *Estuaries, *District of Columbia, *Bottom sediments, Virginia, Maryland, Sampling, Methodology, Analysis, Analytical techniques, Phosphorus, Nitrogen, Chemical oxygen demand, Chlorophyll, Data col-lections, Sediments. Identifiers: *Potomac estuary, *Potomac river.

During the years of 1966 through 1968 the Chesapeake Technical Support Laboratory, conducted three separate surveys of the bottom sediments of the tidal portion of the Potomac River to determine the existing quality of the river bottom. The results of these investigations are presented and the sampling procedures and analytical methods are described. In 1966 the Potomac River between the 14th Street Bridge in Washington, D.C. to the U.S. Route 301 Bridge near Morgantown, Maryland, was sampled three times, March-May, June-August and September-October. In 1967 the same portion of the river was sampled twice, March-April and again during September. In 1968 the river between the U.S. Route 301 Bridge to the mouth of the river at Point Lookout was sampled once during February. The parameters measured include total phosphorus, inorganic phosphorus, total nitrogen, ammonia nitrogen, chemical oxygen demand, wet weight, dry weight, volatile weight and chlorophyll a. (Woodard-USGS) W71-08078

SUMMARY OF ENVIRONMENTAL MONITOR-ING AT AMES LABORATORY, 1962-1969, Environmental Protection Agency, Rockville, Md.

Radiation Office.

Radiological Health Data and Reports, Vol 12, No 3, p 119-128, Mar 1971. 10 p, 3 fig, 10 tab, 7 ref.

Descriptors: *Pollutant identification, Environ-Descriptors: "Poliutant Identification, Environ-mental effects, "Radioactive waste, "Monitoring, "Radioactivity effects, Analytical techniques, lowa, Surface waters, Groundwater, Soils, Vegetation, Atmosphere, Sediments, Radiation, Sampling, Data collections

Identifiers: *Environmental pollution, *Ames Laboratory Research Reactor facility, Iowa State University

The Ames Laboratory Research Reactor facility (ALRR), operated for the U.S. Atomic Energy Commission by the Iowa State University of Science and Technology, reached full power in July 1965. The preoperational and present environmental monitoring program consists of gross alpha and gross beta radioactivity determinations in air, soil, vegetation, river water, ALRR outfall, river bottom sediment, precipitation, well water, and pond water samples. River water samples are collected weekly and analyzed for gross alpha and gross beta radioactivity. One-liter samples are filtered and counted separately as suspended and dissolved solids. Yearly averages for gross beta radioactivity in suspended and dissolved solids in river water

samples for each sampling site from 1963 to 1969 are tabulated. The environmental sampling program is maintained to provide information regarding the effectiveness of control measures and to determine whether any radiological changes in the environment are the result of laboratory operations. (Woodard-USGS)

ON THE BALANCES OF Sr-90 AND Cs-137 IN

THE BALTIC SEA, Institute of Marine Research, Helsinki (Finland); and Institute of Radiation Physics, Helsinki (Fin-

Aarno Voipio, and Anneli Salo. Nordie Hydrology, Vol 2, No 1, p 57-63, 1971. 7 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Fallout, *Strontium radioisotopes, *Cesium, *Sea water, Surveys, Geochemistry, Water chemistry. Path of pollutants, Water balance, Radioisotopes, Radiochemical analysis, Distribution patterns.

Identifiers: *Finland, *Baltic Sea.

The total amounts of Sr-90 and Cs-137 that accumulated in the water of the Baltic Sea in the years 1960-67 are estimated on the basis of 10-15 samples collected annually. There are no significant sources of the radionuclides in the area other than atmospheric deposition on land and sea surface. The amounts of nuclides transported by the outflow through the Danish Sounds were evaluated from the nuclide concentrations found in the surface waters of the southern Baltic and the Danish Sounds, and the mean outflow. The estimated balance of strontium-90 based on the present data is in accordance with the known fact that the strontium concentration is a conservative property of sea water. The estimate does not indicate any rapid removal of cesium-137 from Baltic Sea water by geochemical or biological processes. (Knapp-USGS) W71-08086

WATER QUALITY EVALUATION OF THE MIDDLE RIVER ROUGE BASIN.

Michigan Water Resources Commission, Lansing. Dept. of Conservation.

Michigan Water Resources Commission, Department of Conservation, Lansing, Oct 1967. 59 p, 10

Descriptors: *Water quality, *Water pollution control, *Water pollution effects, *Watershed management, *On-site investigations, Erosion conhadagement, On-site investigations, troson con-trol, Michigan, Impaired water quality, Water anal-ysis, Water quality control, Water quality act, Michigan. Identifiers: *Middle River Rouge (Mich), Wayne

County (Mich).

The water quality of flows in the Middle River Rouge was studied, based upon water samples collected at 18 locations on the river. The River Rouge basin is located in the southeastern portion of Michigan's Lower Peninsula, principally in Wayne County. The area drained by the Middle River Rouge is approximately 117 square miles. It was found that the water quality of the Middle River Rouge, particularly in its lower reaches, is seriously degraded. Indications of this degradation are: low dissolved oxygen concentration; high concentrations of oxygen demanding 5-day BOD substances, inorganic nutrients, coliform bacteria, and visible films of oil. The causes of water quality degradation include combined sewer diversions, trash accumulation, industrial waste discharge and soil erosion. Heavy use is made of the river and adjacent land areas. Recreational uses are of prime importance. These uses will probably increase in the future and a higher quality of water will be required to meet the standards set for these uses. The report includes descriptions of Basin characteristics, developments within the Basin, causes of water quality deterioration and implications thereof, and suggestions for correcting the causes of water quality deterioration. The corrective measures suggested include: providing incentives to contractors to adopt practices that minimize soil erosion; encouraging municipalities to treat waste water and reduce combined sewer overflows; eliminate improperly treated and untreated industrial waste water discharges; and preventing trash accumulations that contribute to stream contamination. (Poertner) W71-08128

THE SOURCE IDENTIFICATION OF MARINE HYDROCARBONS BY GAS CHROMATOG-

RAPHY,
Woods Hole Oceanographic Institution, Mass.
Manfred Ehrhardt, and Max Blumer.
American Chemical Society National Meeting, Los
Angeles, California, Mar 28 - Apr 2, 1971. 8 fig, 2 tab. 23 ref.

Descriptors: *Oil wastes, *Gas chromatography, Water pollution sources, Oceans, Water pollution, Degradation, Chromatography, Analytical techniques, Fuels, *Pollutant identification. Identifiers: *Marine Hydrocarbons, identification.

The annual oil spillage rate into oceans is between 5 and 10 million tons of oil. Legislative and executive actions to reduce oil pollution in the seas will depend upon techniques for identifying the polluting sources. The technique described here is detecting the hydrocarbon compositional differences of oil and oil products by gas chromatography. Gas chromatograms of eight crude oils are produced. How this method distinguishes between recent How this method distinguishes between recent, biogenic hydrocarbons and fossil fuels is discussed. The role of oil degradation by evaporation, dissolution, bacterial degradation, and chemical degrada-tion is examined. The potential of oil spill identification by gas chromatography is exemplified by analysis of two beach tars, one from the shores of Bermuda, and the other from the shores of Martha's Vineyard, Massachusetts. (McEntyre-PAI) W71-08155

FLORIDA MIDDLE GROUND,

Florida State Univ., Tallahassee. Dept. of Oceanog-

raphy.
For primary bibliographic entry see Field 02L. W71-08159

FIELD DETERMINATION OF BACTERIAL DIS-APPEARANCE IN SEAWATER,

Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.

Poul Harremoes. Water Research, Vol 4, No 11, p 737-749, Nov

1970. 8 fig, 2 tab, 5 ref. Descriptors: *Coliforms, *Sea water, *On-site investigations, *Public health, Data collections, Sewage bacteria, Sewage effluents, Tracers, Sampling, Bacteria, *Pollutant identification.

Identifiers: Bacterial disappearance, Continual tracer release, Instantaneous tracer release

Concern arises for bathing hazards in seawater contaminated by viable bacteria from sewage discharges into the sea. Seawater is, however, lethal to coliform bacteria but causes for this are insufficiently known. Two methods are presented for field determination of bacterial disappearance in sea-water with an inaccuracy of less than 10 per cent. One method consists of a continuous conservative tracer release into the sewage outflow with simultaneous sampling for bacterial counting and monitoring of dilution. A case study of Gentote in The Sound between Denmark and Sweden is presented using this first method. The second method of determining bacterial disappearance consists of an instantaneous tracer release into the sewage outflow and measurements taken whereby the disappearance rate equals the ratio between tracer dis-

appearance and bacterial disappearance from the surface layer. A case study of Manila Bay is presented using this second method. In both methods the rate of disappearance is defined on the basis of continuity-the ratio between the bacterial flux as measured and the bacterial flux as would have been if no disappearance were taking place. (McEntyre-PAI)

SANITARY-BIOLOGICAL INVESTIGATIONS OF COASTAL SEA WATER AROUND NORTH SEA ISLAND OF SYLT (IN GERMAN),

Kiel Univ. (West Germany). Institut fuer Bioklimatologie und Meeresheilkunde.

Helgolaender Wissenschaftliche Meeresunter-suchungen, Vol 21, No 3, p 310-319, Dec 1970. 1 fig, 2 tab, 12 ref.

Descriptors: *Sewage bacteria, *Beaches, *Public health, *Pathogenic bacteria, On-site investigations, Sewage effluents, Water pollution, Human pathology, Coliforms, Oceans, Bacteria, Data collections, *Pollutant identification. Identifiers: *Island of Sylt, *North Sea, Germany.

The island of Sylt is an important German recreation center in the southern North Sea. The sewage from the island's villages is emptied directly into the sea waters between the island and the German coast. A study was made in 1967 and 1968 to determine if sewage pollution occurred at the beaches of Sylt's open sea coast. Chemical qualities, a general bacterial count, and coli-titre of 225 water samples were taken around the island to determine the water quality for bathing. Results showed that except for narrow areas left and right of the sewage outlets of the four sewage plants, the upper limit of bacterial number and of the coli-titre was not reached. Coli-titre comparisons revealed a tidal drift of sewage-contaminated waters from the 'Wattenmeer' coast to the open sea beach. While the general number of bacteria depends on organic matter concentration, the absolute number of sewage bacteria can be estimated only by the colititre. A continual check of the pathogenic sewage bacteria, Bacterium coli and the coliform bacteria, in the sea water is necessary for public health. (Mc Entyre-PAI) W71-08162

WHY DOES IT SMELL SO BAD,

Wisconsin Univ., Madison. Dept. of Agricultural Engineering

Clyde L. Barth.

Paper presented at the 1970 Annual Meeting American Society of Agricultural Engineers, ASAE 70-416. 22 p, 5 fig, 1 tab, 65 ref.

Descriptors: *Odor, Farm wastes, Pollutants, Strength, Temperature, Instrumentation, Measure-

Identifiers: *Smell, Olfactory mechanism, Perception, Theories, Literature, Odor quality, Stimuli.

Researchers must learn more about manure odor production and control. Many unanswered problems face the farmer now. A review of pertinent literature clarifies the present status of the knowledge of odor perception, and creates an awareness of the pitfalls to be avoided in planning, conducting and analyzing odor related research. (Christenbury-lowa State) W71-08213

5B. Sources of Pollution

AN EVALUATION OF THE 1968 FISH KILL IN THE DES MOINES RIVER BELOW DES

Iowa State Dept. of Conservation. Biology Section. For primary bibliographic entry see Field 05C.

CLEVELAND FACES POLLUTION SUIT. For primary bibliographic entry see Field 05G. W71-07853

SNOW-REMOVAL PROTECT SALT AND PREVENT WATER POLLUTION, For primary bibliographic entry see Field 05G W71-07859

EFFECT OF SEASONAL EFFLUENT CHLORINATION ON COLIFORMS IN JAMA-EFFLUENT ICA BAY,

For primary bibliographic entry see Field 05F. W71-07873

LEACHING OF NUTRIENTS BY DRAINAGE

Litovskaya Selskokhozyaistvennaya Akademiya SSR, Kaunas Z. B. Kinderis

Trans. from Pochvovedeniye, No 2, 1970. Soviet Soil Science, No 1, p 99-108, 1970. 1 fig. 4 tab, 19

Descriptors: *Nutrients, *Soils, *Leaching, *Aquifer characteristics, Soil analysis, Test procedures, Chemical properties, Groundwater, Soil water, Solubility, Soil water transmissivity. Identifiers: Lithuania (USSR).

Samples of water were periodically collected from Samples of water were periodically collected from tile drainage system established in a weakly pod-zolized diorn-gley soil. Analyses included deter-mination of potassium, sodium, calcium, magnesi-um, and carbonate, nitrate, sulfate, and chloride radicals. The removal of chemical constituents varied depending upon the season and meteorological conditions, rate of water discharge, nature of crops, and fertilizer treatments. (Wilde-Wisconsin) W71-07887

NUTRIENT SUPPLY AND PRIMARY PRODUCTION IN CLEAR LAKE, EASTERN ONTARIO, Trent Univ., Peterborough (Ontario).

D. W. Schindler, and J. E. Nighswander.
Journal Fisheries Research Board of Canada, Vol. 27, No. 11, p. 2009-2036, 1970. 16 fig. 11 tab. 57

Descriptors: *Precipitation (Atmospheric), *Nutrients, *Primary productivity, *Phytoplankton, Productivity, Oligotrophy, Standing crop, Chemical properties, Water pollution sources, Nitrogen, Phosphorus, Eutrophication, Calcium, Ions, Magnesium, Fertility, Watershed management, Lakes, Limnology, Evapotranspiration, Ruster Chemical Components, Pyrrophyta. noff, Chrysophyta, Cyanophyta, Pyrrophyta. Identifiers: *Clear Lake (Ontario), *Canadian Shield, Morphometric features.

Phytoplankton production in a small Canadian Shield Lake, largely uninfluenced by humans, was studied in relation to physical, chemical, and geological factors. Primary production is extremely high for a lake with low phytoplankton standing crop and nutrient supply and production is not reflected in the chemical regime person. reflected in the chemical regimes normally used as indicators of lake metabolism. Production during the ice-free season ranged from 0.10 to 2.57 grams carbon/sq m per day and averaged 250 grams carbon/sq m per year for the lake as a whole. Limnologically, Clear Lake is a typical oliogotrophic lake. The high production values are partially explained by the high correction for filtration error which averaged 3.2 times for all occasions tested. Since the Clear Lake system has no inlet streams from other lakes, a single discrete outlet, and little or no groundwater flow, a nutrient 'loading rate' could be calculated. Vegetation is lush probably reflecting higher annual precipitation in the area. Major source of supply of the nutrients, nitrogen and phosphorus, and calcium and magnesium, is attended to the control of th mospheric precipitation. Sodium potassium, and silica apparently enter from terrestrial watershed. W71-07890

Group 5B—Sources of Pollution

PHOSPHORUS IN WATER AND WASTE WATER-AN ANNOTATED SELECTED

BIBLIOGRAPHY,
North Carolina Univ., Chapel Hill. Waste water

Linda W. Little.

Waste water Research Center Report No 11, Nov 1970, 118 p. FWRA Contract No 14-12-505.

Descriptors: *Bibliographies, *Water pollution sources, *Water pollution effects, *Water pollution control, *Phosphorus, Nitrogen, Soils, Effluents, Aquatic productivity, Chemical reactions, Analy-

sis, Sewage treatment. Identifiers: Phosphorus removal, Phosphorus analysis, Biological effects.

This volume comprises a selected annotated bibliography pertinent to sources of phosphorus in water and waste water, effects of phosphorus on aquatic systems, behavior of phosphorus in soils and waters, phosphorus analysis, and removal of phosphorus from waste water. Contains 281 entries. (Wilde-Wisconsin) W71-07894

STREAM POLLUTION EXAMINATION BY BIOLOGICAL TESTS, Vysoka Skola Chemicko-Technologicka, Prague

(Czechoslovakia).

For primary bibliographic entry see Field 05A. W71-07895

THE EFFECTS OF VARYING CONCENTRA-TIONS OF NUTRIENTS, CHLORINITY, AND DISSOLVED OX', GEN ON POLYCHAETOUS ANNELIDS.

California State Coll., Long Beach. Dept. of Biolo-

For primary bibliographic entry see Field 05C. W71-07899

INFLUENCES OF STRIP MINING ON THE HYDROLOGIC ENVIRONMENT OF PARTS OF BEAVER CREEK BASIN, KENTUCKY, 1955-66, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07935

PRECIPITATION AND RUNOFF, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C.

GROUNDWATER, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07937

GEOCHEMISTRY OF WATER,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07938

EROSION AND SEDIMENTATION,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05C. W71-07939

REMOTE SENSING OF LUMINESCENT MATERIALS,

Geological Survey, Washington, D.C.; and Perkin-Elmer Corp., Norwalk, Conn. For primary bibliographic entry see Field 07B. W71-07961

BIOLOGICAL SURVEY OF THE EFFECTS OF URANIUM MILLING WASTES ON THE WATER QUALITY OF THE SERPENT RIVER BASIN.

Ontario Water Resources Commission, Toronto. For primary bibliographic entry see Field 05D.

W71-08011

DEFINING THE PROBLEM FOR INDUSTRIAL WASTE HANDLING AT HIRAM WALKER AND

SONS LTD., Hiram Walker and Sons Ltd., Toronto (Ontario). For primary bibliographic entry see Field 05G.

WATER ON THE BASAL LENS IN KAHUKU PLANTATION, OAHU AND PIONEER MILL AND HAWAIIAN COMMERCIAL AND SUGAR COMPANY PLANTATIONS ON MAUI, Hawaii Univ., Honolulu. THE EFFECTS OF RETURN IRRIGATION

For primary bibliographic entry see Field 05C. W71-08044

CONCENTRATIONS OF POLLUTANTS IN AGRICULTURAL RUNOFF,
Texas Tech. Univ., Lubbock. Dept. of Civil En-

gineering; and Texas Tech. Univ., Lubbock. Dept. of Chemistry.

Dan M. Wells, Ellis W. Huddleston, and Robert G.

Rekers

Partially supported by FWQA. Water Resources Bulletin, Vol 7, No 1, p 124-132, Feb 1971. 9 p, 3

Descriptors: *Lakes, *Water quality, *Texas, *Farm wastes, *Water pollution sources, Runoff, Nutrients, Solutes, Nitrates, Phosphates, Herbicides, Pesticides, Playas, Overland flow. Identifiers: Agricultural runoff.

Eighteen rural lakes in Lubbock County, Texas, were sampled on a routine basis following runoffproducing rainfall for a period of approximately eighteen months to determine whether or not runoff from intensively farmed agricultural areas contained significant concentrations of nitrates, phosphates, herbicides, or insecticides. An additional fifteen lakes lying within a triangle bounded by the cities of Plainview, Canyon, and Hereford, Texas, were sampled one time during the summer of 1969 to provide additional data regarding the nature and extent of the potential problem in an area with a different soil type and a slightly dif-ferent cropping pattern. Based on results of detailed analyses of approximately two hundred samples of water collected from the lakes and an equal number of sediment samples collected from the same lakes at the same time, it appears that the concentrations of all chemical pollutants in runoff from agricultural lands in the High Plains are well below the allowable concentrations for drinking water. (Knapp-USGS) W71-08053

HYDROLOGY OF THE YTHAN ESTUARY WITH REFERENCE TO DISTRIBUTION OF MAJOR NUTRIENTS AND DETRITUS,

Aberdeen Univ., Newburgh (Scotland). Culterty

For primary bibliographic entry see Field 02L. W71-08062

HYDROGRAPHIC OBSERVATIONS IN THE EASTERN IRISH SEA WITH PARTICULAR REFERENCE TO THE DISTRIBUTION OF NUTRIENT SALTS,

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab. P. G. W. Jones, and A. R. Folkard.

Journal of the Marine Biological Association of the

United Kingdom, Vol 51, No 1, p 159-182, Feb 1971. 24 p, 10 fig, 3 tab, 20 ref.

Descriptors: *Path of pollutants, *Nutrients, *Phosphates, *Nitrates, *Sea water, Industrial wastes, Runoff, Farm wastes, Productivity, Fish, Fisheries, Hydrography, Oceanography, Salinity, Water analysis. Identifiers: *Irish Sea.

A series of surveys investigating the distribution of nutrient salts in the eastern Irish Sea was made between May 1965 and April 1968, concentrating on the winter and early summer period. During the on the winter and early summer period. During the winter, the greatest concentration of nutrient salts occurred in the low-salinity inshore water. Plankton production considerably modified the distribution of nutrient salts during the summer, masking the relationship with salinity. An area of very high phosphate values was found off St. Bees Head and was traced to effluent from a nearby chamical phosphate values was found off St. Bees Head and was traced to effluent from a nearby chemical works. The distribution of one nutrient salt ratio to another was studied during the winter survey. The N:P and Si:P ratios were related to salinity and hence to the degree of terrestrial runoff. The N:Si ratio did not conform to this pattern. The current systems of the area may be subject to variation. (K-napp-USGS)
W71-08063

A STUDY ON CHANGES IN QUALITY OF UNDERGROUND WATER,
Tabela House, Kota (India). Agricultural Chemis-

B. L. Darra, Harvinder Singh, and R. S. Mendiratta. Journal of Soil and Water Conservation in India, Vol 18, Nos 1 and 2, p 1-3, Jan-June 1970. 3 p, 3 tab. 6 ref.

Descriptors: *Water quality, *Return flow, *Groundwater, *Saturated soils, *Irrigation effects, Leaching, Water level fluctuations, Saline soils, Land reclamation, Path of Pollutants. Identifiers: *India.

Underground well waters were collected in pre and post seasons to assess the changes brought about in quality of waters in the two irrigation seasons under saline and saline-alkali water logged areas of Bundi district of Chambal command, India. The quality of oustret of Chambai command, India. The quality of water slightly improved after rains, while in another part it was slightly impaired. The canal water is of good quality. Efforts are in progress to decrease the salt contents of the surface by leaching and flushing aided by lowering the water table using surface drainage facilities. Simultaneously other soil reclamation measures have also been undertaken to boost crop production. (Knapp-USGS) W71-08073

SUMMARY OF ENVIRONMENTAL MONITOR-ING AT AMES LABORATORY, 1962-1969, Environmental Protection Agency, Rockville, Md.

Radiation Office.

For primary bibliographic entry see Field 05A. **W71-**0808Ó

THE SOURCE IDENTIFICATION OF MARINE HYDROCARBONS BY GAS CHROMATOG-

RAPHY, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05A. W71-08155

POLLUTION SYMPOSIUM,

Office of Naval Research, London (England). John D. Costlow, Jr.

Available from the National Technical Information Service as AD-823 621, \$3.00 in paper copy, \$0.95 in microfiche. ONRL Conference Report C-21-67, 21 Nov 1967. 6 p.

Descriptors: *Water pollution, *Marine fisheries, *Oceans, Hydraulic models, Fishes, Metals, Radioactive wastes, Oil wastes. Identifiers: *North sea, Marine biology.

An account is given of the three-day symposium 'Biological and Hydrographic Problems of Water Pollution in the North Sea' held at Helgoland, Germany in September 1967. The forty papers which were presented considered various aspects of the major sources of pollution, the biological and hydrographical processes determining the fate of pollutants, the biological and hydrographical con-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

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sequences of pollution, and general and local aspects of pollution. W71-08167

ANIMAL WASTES,

Guelph Univ. (Ontario). Dept. of Soil Science. L. R. Webber.

Journal of Soil and Water Conservation. Vol 26, No 2, p 47-50, Mar-Apr 1971. 21 ref.

Descriptors: *Farm wastes, *Disposal, Pollutants, Pollution abatement, Groundwater, Farm lagoons, Treatment, Anaerobic digestion, Aerobic treat-ment, Management, Water pollution sources. Identifiers: Contamination, Feedlots, Waste removal, Composting.

Some waste management problems resulting from high-density confinement of livestock are discussed. Treatment and disposal of the waste material causes the most troublesome problems. There are many systems in use, with anaerobic or aerobic lagoon treatment more common. Man has always used land as the ultimate disposal medium for many kinds of waste. Agriculture finds itself in the challenging position of being able to use or dispose of vast quantities of animal wastes without polluting the water, soil, or air. (Christenbury-Iowa State) W71-08205

CATTLE FEEDLOT RUNOFF - ITS NATURE AND VARIATION,

Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.

J. R. Miner, R. I. Lipper, L. R. Fina, and J. W.

Journal Water Pollution Control Federation, Vol 38, p 1582-1591, 1966. 8 fig, 11 tab, 12 ref.

Descriptors: *Farm wastes, *Runoff, *Bacteria, Cattle, Simulated rainfall, Hydrographs, Chemical oxygen demand, Biochemical oxygen demand, Nitrogen, Temperature, Pollutants, Water pollution sources.

Identifiers: Kjeldahl nitrogen, Feedlot runoff, Suspended solids, Chemical quality, Most probable

Runoff from cattle feedlots is a high-strength organic waste produced during and immediately after rainfall. These studies indicated that greatest pollutant concentrations are obtained during warm weather, during periods of low rainfall intensity, and when the manure has been made soluble by soaking with water. Correlations were developed to predict runoff oxygen demand and nitrogen content based on these factors. In addition, the following points were demonstrated: (1) Feedlot runoff is a source of high concentrations of bacteria normally considered as indices of sanitary quality, and (2) runoff from a concrete-surfaced lot was more heavily polluted than that from a nonsurfaced lot under similar conditions. (Christenbury-lowa State) W71-08206

CONTAMINATION OF SURFACE WATERS FROM PLOWED-IN FEEDLOT MANURE,

Kansas State Univ., Manhattan. Dept. of Agricul-

Ransas State Colly, Indianated Francisco Engineering.
R. I. Lipper, H. L. Manges, and Eugene Goering.
Paper presented at the 1971 Mid-Central Meeting
American Society of Agricultural Engineers, Paper
No MC-71-803. 4 p.

Descriptors: *Farm wastes, *Disposal, Confinement pens, Pollutants, Runoff, Chemical oxygen demand, Water pollution sources. Identifiers: *Feedlot manure, Plowed-in.

When a four-inch layer of beef feedlot manure was completely covered with 2 to 3 inches of soil in small test plots, no organic contamination of water on the soil surface resulted when plots were well drained. Under conditions simulating standing

water on tight soil, COD of the water was very high. (Christenbury-Iowa State) W71-08215

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS.

Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div. B. A. Stewart, F. G. Viets, Jr., G. L. Hutchinson,

and W. D. Kemper.
Environmental Science and Technology, Vol 1, No 9, p 736-739, 1967. 2 fig, 1 tab, 1 ref.

Descriptors: *Nitrates, *Water pollution sources, Leaching, Farm wastes, Groundwater, Hydraulic conductivity.

Identifiers: Organic carbon, Feedlots.

Agriculture's effect on nitrate pollution of groundwater was investigated in the South Platte valley of Colorado. The valley is intensively farmed and contains many concentrated livestock feeding operations. A water table, generally between 3 and 20 meters below the surface, underlies much of the area. The average total nitrate-nitrogen to a depth of 6.7 meters in the profiles for the various kinds of land use was: alfalfa (Medicago sativa) (13 cores), 70; native grassland (17 cores), 81; cultivated dryland (21 cores), 233; irrigated fields not in alfalfa (28 cores), 452; and feedlots (47 cores), 1282 kg. per hectare. Groundwater samples often contained high concentrations of nitrate, and those obtained beneath feedlots contained ammonium-nitrogen and organic carbon. Data presented show that nitrate is moving through the soil and into the groundwater supply under both feedlots and irrigated fields in crops, excluding alfalfa. (Parker-W71-08218

ELECTRIC POWER AND THERMAL DISCHARGES; THERMAL CONSIDERATIONS IN THE PRODUCTION OF ELECTRIC POWER.

Merril Eisenbud and George Gleason, (eds). New York, Gordon and Breach, 1971. 423 p.

Descriptors: *Thermal powerplants, *Thermal pollution, *Electric power demand, *Environmental effects, *Water quality control, *Heated water, *Temperature, *Regulations, *Cooling, Conserva-tion, Beneficial use, Cooling water, Evaporation, Convection, Radiation, Design criteria, Rivers, Estuaries, Mixing, Condensers.

Identifiers: *Cooling systems, *Waste heat utilization, *Waste heat dissipation.

The purpose of the symposium was to bring together experts from industry, the universities and laboratories, and the government to assess the state of our knowledge of the environmental impact of heated discharges from thermal powerplants. The general topics covered include the description of the relationship between electric power and the environment; projected demand for electric power and thermal output; the effects of temperature variations on the aquatic ecosystems; the scientific rationale for federal and state water quality standards: the impact of environmental considerations on the design and operation of power facilities; the technological alternatives for minimizing waste heat rejection; and, the beneficial utilization of waste heat. (See also W71-08299 thru W71-08316) (Oleszkiewicz-Vanderbilt)

THE POWER INDUSTRY AND THE ENVIRON-

Public Service Co. of New Hampshire, Manchester. William C. Tallman.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, 1971, p 1Descriptors: *Electric power demand, *Electric power industry, *Environmental effects, *Thermal powerplants, Thermal pollution.
Identifiers: Electric Power Council on Environ-

The paper presents the basic objectives of the Electric Power Council on Environment established in September, 1969: (1) to promote and coordinate electric utility programs in the environment field, (2) to encourage communication between the electric power industry and all others concerned with the environment, and (3) to stimulate research and to make recommendation in regard to environmental considerations. In the discussion of electric tal considerations. In the discussion of electric power and the environment, the author points out that the electric energy component is now about 20-25% of the total and is growing at a rate about 2 1/2 times faster than is the total use of energy. It is expected that by the year 2000 electric energy will represent about 50% of all energy utilized. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08299

THE POWER ENVIRONMENT OF THE 1970'S, Department of Water and Power, Los Angeles, Calif.

Floyd L. Goss

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, 1971, p 7-

Descriptors: *Electric power demand, *Electric power industry, *Thermal powerplants, *Environmental effects, *Thermal pollution. Identifiers: National Electric Reliability Council.

After presentation of the status and activities of the recently formed National Electric Reliability Council (NERC), the author states that by 1980 new cil (NERC), the author states that by 1980 new generating capacity will be installed at a rate of 46,000 Mw per year, which is expected to increase to 66,000 by 1985. Bearing in mind the beneficial effects of installed capability, the author points out that many of the proposed restrictions on the environment are based on mere supposition. Some results of actual operating experience can differ radically from theoretical predictions: (1) both king salmon, striped bass and opossum shrimp can be passed through the operating condensers of a be passed through the operating condensers of a power plant with a high survival rate; (2) the temperature increase imposed by thermal discharges in tide waters does not cause changes in the DO content of the water; (3) natural temperature flutuations in Californian bays and open ocean may vary greatly and considerably exceed those resulting from the thermal power plant's discharges. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08300

ELECTRIC POWER AND THERMAL OUTPUT IN THE NEXT TWO DECADES, Federal Power Commission, Washington, D.C.

F. H. Warren.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, 1971, p 21-46. 2 fig, 7 tab.

Descriptors: *Electric power demand, *Thermal power plants, *Environmental effects, *Thermal pollution, *Cooling towers, Cooling water. Identifiers: Federal Power Commission, *Waste heat, Cooling ponds.

Estimates of potential waste heat output and related cooling needs in six basic regions of the United States are presented. Four methods of cooling have been considered in the periods 1971-1980 and 1981-1990: fresh water once-through cooling; fresh water cooling ponds; fresh water evaporative cooling towers; and once-through cooling using saline water. Detailed analysis of presented data is followed by the conclusions that continual assessment of the benefit-to-cost ratio will provide the best guide for decisions in critical judgment cases.

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The high ratio of waste heat to useful electrical ne night ratio of waste near to useful electrical energy generated emphasizes the need to press every possible means of improving the efficiency of present generating systems. (See also W71-08298) (Oleszkiewicz-Vanderbilt)

SPECTRUM OF BIOLOGICAL CONCERNS FROM POWER PLANT THERMAL DISCHARGES,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. For primary bibliographic entry see Field 05C. W71-08302

IMPACTS OF THERMAL ALTERATIONS ON ESTUARINE AND COASTAL ENVIRONMENTS, Virginia Inst. of Mari ne Science, Gloucester Point. For primary bibliographic entry see Field 05C. W71-08303

BENEFICIAL USES OF WARM WATER DISCHARGES IN SURFACE WATERS, Texas A and M Univ., College Station. Dept. of

Wildlife Science

For primary bibliographic entry see Field 03C. W71-08304

WATER QUALITY STANDARDS: ENFORCE-MENT AND COMPLIANCE,

Federal Water Quality Administration, Washington, D.C.

For primary bibliographic entry see Field 05G. W71-08305

PRACTICAL IMPLICATIONS OF APPLYING CRITERIA IN A VARIETY OF CONDITIONS, Bureau of Sport Fisheries and Wildlife, Washington, D.C.

For primary bibliographic entry see Field 05G. W71-08306

THERMAL WASTE TREATMENT AND CON-

TROL, Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab. For primary bibliographic entry see Field 05D. W71-08307

DEVELOPING AND APPLYING STANDARDS AT THE STATE LEVEL,

Pennsylvania Dept. of Health, Harrisburg. Div. of Water Quality

For primary bibliographic entry see Field 05G.

CONSIDERATIONS IN TRANSLATING EN-VIRONMENTAL CONCERN INTO POWER PLANT DESIGN AND OPERATION, Duke Power Co., Engineering Department

For primary bibliographic entry see Field 05D.

POWER PLANT COOLING IN PERSPECTIVE. Commonwealth Associates, Inc., Jackson, Mich. Architectural and Engineering Systems. For primary bibliographic entry see Field 05D. W71-08310

SHORT TERM PROSPECTS FOR IMPROVING EFFICIENCY OF POWER PLANTS, Massachusetts Inst. of Tech., Cambridge

For primary bibliographic entry see Field 08C.

ENVIRONMENTAL INFLUENCE ON POWER OPERATION.

American Electric Power Service Corp., New York.

For primary bibliographic entry see Field 05G.

NATURAL BODIES OF WATER FOR COOL-ING.

Sargent and Lundy, Chicago, Ill. For primary bibliographic entry see Field 05D. W71-08313

COOLING TOWERS FOR LARGE STEAM-ELECTRIC GENERATING UNITS, Black and Veatch, Kansas City, Mo. For primary bibliographic entry see Field 05D. W71-08314

THE USE OF RIVER MODELS IN POWER PLANT HEAT EFFECT STUDIES, Worcester Polytechnic Inst., Mass. Alden Research

Lawrence C. Neale. In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 381-416, 1971. 14 fig, 3 photos.

Descriptors: *Model studies, *Thermal powerplants, *Temperature, *Test procedures, Instru-mentation, Froude Number, Reynolds number, Isotherms, Rivers, Estuaries, Reservoirs.

Identifiers: *Distorted models, Temperature sen-

A number of river model studies have been undertaken at the Alden Research Laboratories to determine the influence of heated water effluents on bodies of water. The flow patterns developed from these model studies have been used to predict the flow patterns and temperature patterns in the prototype. Although it is difficult to obtain detailed data from the field after completion of projects, the results that have been obtained indicate good agreement with those of the distorted model study. Receiving water temperature ranged from 32F and temperature differentials produced by condenser cooling have varied from 0 deg to 45F. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08315

UTILIZING WASTE HEAT FOR URBAN SYSTEMS,

Westinghouse Corp., Philadelphia, Pa. Environmental Systems Dept. For primary bibliographic entry see Field 03C. W71-08316

STRATIFICATION OF FLOW FROM CHAN-NEL INTO DEEP LAKE, (DISCUSSION), New South Wales Univ., Kensington (Australia).

Water Research Lab.

For primary bibliographic entry see Field 08B. W71-08321

5C. Effects of Pollution

STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY-I. ON THE FORMATION AND THE TOXICITY OF PRECIPITATE OF HEAVY METALS (JAPANESE),

Kenji Tabata

Bulletin of Tokai Regional Fisheries Research Laboratory, No 58, p 203-214, May 1969. 4 fig, 3 tab, 16 ref.

Descriptors: *Heavy metals, *Hydrogen ion concentration, *Toxicity, *Water pollution effects, Aquatic animals, Calcium, Bicarbonates, Magnesi-Aquatic animais, Calcium, Bicarbonates, Magnesium, Water pollution treatment, Mollusks, Mussels, Shellfish, Daphnia, Fish toxins, Killifishes, Nekton, Mortality, Solutes, Bioassay, Ions, Ion transport. Identifiers: *Zinc, Metals, Cations, Precipitates, Gobies.

Experiments were designed relative to the solubility of Zn..., the factors controlling it and the toxicity of zinc precipitate. The authors found that the precipitate's effect on Japanese killifish, gobies and Daphnia was negligible, and concluded that such precipitates do not harm nekton. In contrast, Mytilus edulis, a sedentary filter feeder, was killed by the precipitate. Rather than being regulated by pH, Zn.... was found to dissolve to a super saturated state in seawater. (See also W71-07725 thru W71-07727) (LeGore-Washington)

STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY...II. THE ANTAGONISTIC ACTION OF HARDNESS COMPONENTS IN WATER ON THE TOXICITY OF HEAVY METAL IONS (JAPANESE), Kenii Tabata

Bulletin of Tokai Regional Fisheries Research Laboratory, No 58, p 215-232, May 1969. 9 fig, 2

Descriptors: *Heavy metals, *Water pollution effects, *Toxicity, Aquatic animals, Calcium, Cobalt, Copper, Magnesium, Fish toxins, Killifishes, Daphnia, Nekton, Mortality, Water pollution treatment, Rainbow trout, Trout, Carp, Bioassay, Laboratory tests, Ions, Ion transport. Identifiers: *Enhancement, Cadmium, Nickle,

Zinc, Mercury, Ctenopharyngodon sp., Pseudorasbora sp., Synergism, Antagonism, TLm.

The toxicity antagonism between components of water hardness and heavy metal ions were examined. The TLm of the metals (Cu..., Zn..., Ni..., Co... and Cd...) increased almost 2.8 plus or minus 0.6 fold when water hardness was increased eightfold by addition of CaCl2 and MgSO4. Hg.... and Mn... toxicity was unaffected by water hardness. Toxicity of hexavalent Cr was affected in the case of Daphnia, but not in the case of carp as test animals. Sodium ion increased the TLm of Zn..., Cu..., Cd..., Ni... or Co..., but potassium ion had no effect. (See also W71-07724) (LeGore-Washington) W71-07725

STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY-III.
ON THE LOW TOXICITY OF SOME HEAVY METAL COMPLEXES TO AQUATIC ANIMALS (JAPANESE),

Katsuo Nishikawa, and Kenji Tabata. Bulletin of Tokai Regional Fisheries Research Laboratory, No 58, p 233-241, May 1969. 2 fig, 5 tab, 12 ref

Descriptors: *Heavy metals, *Water pollution ef-Descriptors: "Heavy metas, "water pollution effects, "Toxicity, Aquatic animals, Copper, Cobalt, Fish toxins, Water pollution effects, Carp, Bioassay, Laboratory tests, Fish farming, Fish physiology, Competition, Ions, Ion transport. Identifiers: *EDTA, Mercury, Nickle, Complexing agents, Antagonism, TLm.

The effects of complexing agents on toxicity of heavy metal ions to aquatic animals were investigated. The authors found that sodium thiosulfate and sodium citrate considerably decrease such toxicity. As the degree of the decreases agreed with the stability constants of heavy metal complexes formed, it was assumed that the decreases might be caused by the low toxicity of heavy metal complexes. The acute toxicity of all heavy metal-EDTA complexes, however, was about the same without reference to the toxicity of each heavy metal ion. It was felt, therefore, that toxicity might be attributable to EDTA. Carp were successfully reared in a concentration of sodium thiosulfate-complexed Cu.... corresponding to ten times the TLm of the uncomplexed Cu.... (See also W71-07724) (LeGore-Washington) W71-07726

Effects of Pollution—Group 5C

STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY--IV. ON THE RELATION BETWEEN THE TOXICITY OF HEAVY METALS AND THE QUALITY OF ENVIRONMENTAL WATER (JAPANESE),

Bulletin of Tokai Regional Fisheries Research Laboratory, No 58, p 243-253, May 1969. 2 fig, 4

Descriptors: *Heavy metals, *Fish toxins, *Water pollution effects, *Toxicity, *Assessments, Aquatic animals, Daphnia, Mortality, Rainbow trout, Trout, Carp, Bioassay, Laboratory tests, Ions, Ion transport, Water pollution sources, Water policy. Identifiers: *Zinz, Pseudorasbora sp., Girella sp.,

TLm, Sweetfish.

Twenty-four hr TLm values of Zn.... to Daphnia in water samples from eight freshwater areas were determined, and it was found that results could be applied to the natural situation. The fifty important applied to the natural situation. The lifty important rivers and lakes in Japan were classified into six groups according to water hardness, and the differences in toxicity of heavy metal ions among these groups was estimated. As a trial to exhibit permissible concentrations of heavy metals for aquatic animals which agreed with the biological and the environmental conditions in each water area, the permissible concentrations of Zn.... TO carp, Pseudorasbora, rainbow trout, sweetfish, Girella or Daphnia in the above fresh and sea water groups were calculated on the basis of 48 hr TLm values. (See also W71-07724) (LeGore-Washington) W71-07727

THE EFFECT OF TEMPERATURE ON CATA-LYTIC AND REGULATORY FUNCTIONS OF PYRUVATE KINASES OF THE RAINBOW TROUT AND THE ANTARCTIC FISH TREMATOMUS BERNACCHII, British Columbia Univ., Vancouver. Dept. of

Zoology. G. N. Somero, and P. W. Hochachka. Biochemical Journal, Vol 110, p 395-400, 1968. 5

fig, 2 tab, 36 ref.

Descriptors: *Fish physiology, *Rainbow trout, *Enzymes, Water temperature, Regulation, Environmental effects, Mode of action, Biochemistry, Animal metabolism, Inhibition, *Thermal pollution, Water pollution effects, Temperature.

Identifiers: *Pyruvate kinases, *Trematomus bernacchii, *Enzyme activity, Antarctic fish, Km, Temperature dependence, ATP, Phosphoenol pyruvate, Fructose diphosphate. ADP.

The Km value of pyruvate kinase for one of its two substrates, phosphoenolpyruvate, is temperature-dependent, and is lowest at temperatures that closely coincide with the habitat temperatures of the two fishes. Two regulatory functions of pyruvate kinase, feed forward activiation by fructose diphosphate and feedback inhibition by ATP, are temperature-independent. Enzyme-ADP interaction is also temperature-independent. It is concluded that enzyme-substrate and enzyme-modulator interactions are important factors in short-term and in evolutionary adaptations by poikilotherms to changes in temperature. (Sjolseth-Washington) W71-07728

ZOOPLANKTON, ZOOBENTHOS, AND BOTTOM SEDIMENTS AS RELATED TO POLLUTION AND WATER EXCHANGE IN THE OSLOFJORD,

Oslo Univ. (Norway). Inst. of Marine Biology.

Fredrik Beyer.

Helgolaender wissenschaftliche Meeresunter-suchung, Vol 17, p 496-509, 1968. 7 fig, 1 tab, 28

Descriptors: *Water pollution effects, *Bottom sediments, *Zooplankton, Benthic fauna, Dissolved oxygen, On-site investigations, Bathymetry,

Hydrography, Decomposing organic matter, Water quality, On-site data collections. Identifiers: *Oslofjord, *Oxygen shortage, *Norway, Polychaetes, Bottom coring, Water exchange, Aglantha digitale, Rathkea octopunctata.

Aglantha digitale and Rathkea octopunctata were found in greatest numbers in the most heavily polluted areas, where bottom water and sediment were generally anoxic and azoic. Spionidae, Hesionidae and Nudibranchia thrived in polluted areas when these were not anoxic. The remaining benthos components compared occurred primarily in water of better quality. A consistent and distinct ranking order was found for all these components. In areas where no bottom fauna was found, and in transi-tional zones, black or dark layers in the sediment indicated various degrees of oxygen insufficiency.

Most remarkable differences (variations) were recorded in the successive years of the survey. (Sjolseth-Washington) W71-07729

AN EVALUATION OF THE 1968 FISH KILL IN THE DES MOINES RIVER BELOW DES MOINES,

lowa State Dept. of Conservation. Biology Section.

Jim Mayhew, and Gaige Wunder. Iowa Quarterly Biology Reports, Vol 21, No 2, p 70-72, Apr, May, June 1969. 1 ref.

Descriptors: *Water pollution effects, *Dissolved oxygen, *Oily water, *Oxygen sag, *Fishkill, *Organic loading, *Iowa, Sewage effluents, Water pollution sources, Oil, Oil wastes, Oxygen, Carp, Carpsucker, Catfishes, Channel catfish, Minnows, Organic Catfishes, Channel Catfish ganic wastes, On-site investigations, Municipal

Identifiers: *Des Moines River (Iowa), Tolerance limits, TLm.

A fishkill on the Des Moines River, Iowa occurred in January, 1968, and was associated with the Des Moines Sewage Treatment Plant bypass outfall. The effluent consisted of organic material and thick, heavy oil. Dissolved oxygen downstram from the outfall was less than 2.0 mg/l, but was 10.0.. mg/l above the outfall. D.O. remained low for 35 days. Channel and flathead catfish, carp, river carpsuckers and numerous minnows were affected. Because the river had been under study previously, the authors were able to use tagging techniques to estimate that 54% of the resident channel catfish had been killed. (LeGore-Washington) W71-07730

GLENODININE, AN ICHTHYOTOXIC SUBSTANCE PRODUCED BY A DINOFLAGELLATE, PERIDINIUM POLONICUM,

Tokyo Univ. (Japan). Lab. of Marine Biochemis-

Yoshiro Hashimoto, Tomotoshi Okaichi, Le Dung Dang, and Tamao Noguchi.

Bulletin of the Japanese Society of Scientific Fisherics, Vol 34, No 6, p 528-534, June 1968. 7 fig, 1

Descriptors: *Fishkill, *Toxins, *Algal poisoning, *Algal toxins, *Phytotoxicity, *Fish diseases, *Fish toxins, Toxicity, Hydrogen ion concentration, Dissolved oxygen, Algae, Phytoplankton, Alkaline water, Alkalinity, Fish farming, Fish food organisms, Fish physiology, Red tide, Organic compounds, Dinoflagellates.

Identifiers: *Peridinium sp., *Glenodinine, Alkaloid toxins, Ibogaalkaloid, Organic toxins.

Mass mortalities associated with phytoplankton blooms sometimes occur in Japanese fish culture operations. The authors opine that this may be the first report identifying the toxic species and its associated toxin. The offender, glenodinine, was isolated from the dinoflagellate, Peridinium polonicum. The toxin is an alkaloid showing some resemblance to ibogaalkaloid, and has the sulfhydryl function in the molecule. Fishkills occurred in the afternoon or evening when dissolved oxygen

was high and pH levels of 8.7-9.2 were present. Although mortalities sometimes occurred after blooms rather than concurrently, lethal levels of glenodinine were found in the water during the mortalities. The substance is apparently toxic only in alkaline medium, created by high phytoplanktonic photosynthetic activity. (LeGore-Washington) W71-07731

NOTES ON AN EXPERIMENT UPON THE EFFECT OF CRUDE OIL ON LIVE CORALS, Department of Primary Industries, Brisbane (Aus-

tralia). E. M. Grant.

Fisheries Notes (New Series): No 1, Sept 1970. 3 p. (from: Fisheries Branch, Dept of Primary Industries, Brisbane, Queensland, Australia).

Descriptors: *Oil, *Oily water, *Water pollution effects, *Coral, Oil wastes, Bioassay, Water pollution, Pollutants, Reefs, Aquatic animals, Aquatic environment, Aquatic habitats, Tidal effects. Identifiers: *Favia sp., Australia, Monnie crude oil, Crude oil, Oil spills, Prediction.

Two Turban Corals (Favia speciosa) were kept in ach of three 15 gal saltwater aquaria. One tank served as a control, and three pints of Moonie crude oil were gently layered on the water surfaces of each of the remaining two tanks. Tidal fluctuations were simulated in one 'polluted' tank by gentle siphoning, permitting contact of oil on the coral for shout five minutes each due. Presentions were for about five minutes each day. Precautions were taken to avoid turbulence. On the eighth day oil was skimmed from the surface, and the experiment was continued for an additional 16 days. No coral deaths or ill effects were noted, and the authors suggest that caution should temper predictions as to oil's effects on marine life. This study is regarded as indicative, not definitive. (LeGore-Washington) W71-07732

EFFECTS OF DIELDRIN ON GLUTAMIC OX-ALOACETIC TRANSAMINASE IN POECILIA LATIPINNA,

Rosenstiel School of Marine and Atmospheric

Sciences, Miami, Fla. Charles E. Lane, and Edward D. Scura.

Journal of the Fisheries Research Board of Canada, Vol 27, No 10, p 1869-1871, 1970. 1 fig, 12 ref. FWPCA Grant No 18050 DRL.

Descriptors: *Dieldrin, *Chlorinated hydrocarbon Descriptors: *Dicidrin, *Chlorinated hydrocarbon pesticides, *Pesticide toxicity, *Lethal limit, *Fish physiology, *Fish toxins, *Bioassay, Pesticides, Resistance, Fish diseases, Poisons, Toxicity, Toxins, Enzymes, Pathology, Agricultural watersheds, Gas chromatography, Laboratory tests. Identifiers: *Poecilia sp., *Sailfin molly, Serum enzymes, Glutamic oxaloacetic transaminase.

Sailfin mollies (Poecilia latipinna) were exposed to 0.003, 0.006 and 0.012 ppm dieldrin in sea water at a flow rate of 266 ml/min. Gas chromatography was used to monitor pesticide levels. Blood samples were drawn into capillary tubes directly from the dorsal aorta, and its serum glutamic oxaloacetic transaminase (SGOT) levels were determined by the method of Karmen as modified by Henry et al. Dieldrin caused rapid and great increases in SGOT levels, apparently by inducing cell damage. Although 0.006 and 0.012 ppm killed most fish by 72 hr, final SGOT levels did not correlate with mortality. Surviving fish exposed to only 0.003 ppm accumulated the highest SGOT levels. Considerable variability in resistance to dieldrin among fish was noted. (LeGore-Washington) W71-07733

POSSIBLE METABOLITES OF DIELDRIN IN THE SAILFIN MOLLIE (POECILIA LATIPIN-

Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.

For primary bibliographic entry see Field 05A. W71-07734

Group 5C—Effects of Pollution

THE MINIMUM OXYGEN REQUIREMENTS OF FIVE SPECIES OF FISH UNDER QUIESCENT

CONDITIONS, Oklahoma State Univ., Stillwater.

Walter R. Whitworth, and William H. Irwin.

Proceedings of the 15th Annual Conference of the Southeastern Association of Game and Fish Comm, 1961, p 226-235. 2 tab, 56 ref. NIH Research Grant No RG 6873.

Descriptors: *Oxygen requirements, *Dissolved oxygen, *Fish physiology, *Fish behavior, Minnows, Shiners, Respiration, Mortality, Fishkill, Bioassay, Water pollution effects.

Identifiers: *Oxygen tension, *Survival, Tolerance, Mosquito fish, Oxygen removal, Lebistes reticulatus, Pimephales promelas, Hybognathus placitus, Notropis girardi, Gambusia affinis.

The minimum oxygen requirements of the following five species of fish were studied under quiescent conditions: Lebistes reticulatus, Gambusia affinis, Pimephales promelas, Hybognathus placitus and Notropis girardi. Nitrogen gas was bubbled through the waters in the test vessels to remove the dissolved oxygen. The fish were tested under varied temperatures and at different levels of oxygen depletion. All specimens tested were able to live at oxygen tensions of 1.0 ppm. The reactions of the fish vary with (1) the spread of oxygen removal, and (2) the species. (Sjolseth-Washington) W71-07735

STUDIES OF PRIMARY PRODUCTIVITY IN COASTAL WATERS OF SOUTHERN LONG ISLAND, NEW YORK, Dow Chemical Co., Freeport, Tex; and Puerto Rico

Univ., Mayguez. Dept. of Marine Sciences; and Town of Hempstead, N.Y. Dept. of Conservation and Waterways; and Virgin Islands Coll., St.

For primary bibliographic entry see Field 02L. W71-07875

HIGH MOLECULAR WEIGHT ALGAL SUB-STANCES IN THE SEA,

Naval Undersea Research and Development Center, Pasadena, Calif.

For primary bibliographic entry see Field 02L. W71-07878

THE INTERACTIONS OF Cu.... AND CN- WITH PARAQUAT PHYTOTOXICITY CHLORELLA, TO

Oklahoma State Univ., Stillwater. Dept. of Agrono-

Sue-Fei Tsay, Jhy-Mei Lee, and J. Q. Lynd. Weed Science, Vol 18, No 5, p 596-598, 1970. 2 fig, 1 tab, 9 ref.

Descriptors: *Paraquat, *Chlorella, *Phytotoxicity, Herbicides, Copper, Aquatic plants, Test procedures, Toxicity, Chlorophyll, Metabolism, Pesticides

Identifiers: *Cyanide, *Copper-cyanide interac-

Cultures of Chlorella pyrenoidosa, IAC 251, were grown in inorganic salt media to near the peak of the log phase of growth and then treated with copper sulfate. Following centrifuging and adjustment of cell density, synchronized cultures were subjected to factorial studies of copper, cyanide, and Paraquat herbicide interaction. The toxicity of the compound to algae resulting from the interaction of copper, cyanide, and 1,1'-dimethyl-4,4'-bipyridinium ion of the herbicide was determined by measuring absorbance of chlorophyll at 434 and 670 millimicrons. Copper inhibited phytotoxicity whereas cyanide accelerated activity of the Paraquat with antagonistic interactions between copper (2 ppm) and cyanide (16 ppm) at Paraquat level of 2 ppm. (Wilde-Wisconsin) W71-07881

ON RESEARCH OF HUMIC SUBSTANCES IN

ESTONIAN LAKES (IN GERMAN), Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany. H. Simm.

English summary. Archiv fur Hydrobiologie, Vol 66, No 3, p 273-282, 1969. 2 fig, 1 tab, 9 ref.

Descriptors: *Eutrophication, *Lakes, *Organic matter, *Humus, Bogs, Humic acids, Forest soils, Color, Marshes, Fulvic acids, Oxygen.
Identifiers: *Estonia (SSR), Humic lakes, Potassium dichromate, Permanganate oxidation.

Water of more than 40% of numerous lakes of Estonian Republic exhibits potassium dichromate consumption over 35 mg/l of oxygen. The high content of organic matter is imparted by drainage areas dotted with muskegs, fens, marshes, and lowland forests. A transition from oligorganic to euorganic waters is marked by an increase in the content of colloidal substances and the intensity of water color. Water of lakes influenced by marshy watersheds is enriched in fulvic acid; lakes located in the proximity of raised bogs have a higher content of humic acid. Enclosed table provides data of seasonal changes in oxidation capacity and color of lakes belonging to different levels of organo-eutrophication. (Wilde-Wisconsin) W71-07883

VIRUS OCCURRENCE IN RAW SEWAGE SLUDGE AND EFFLUENT OF A BIOLOGICAL CLARIFICATION PLANT (IN GERMAN), Bundesgesundheitsamt, Berlin (West Germany).

Institut fuer Wasser-, Boden-, und Lufthygiene.

English abstract. Zentralblatt fur Bakteriologie, Parasitenkunde, Infektion, und Hygiene, Vol 212, No 1, p 50-60, 1969.

*Viruses, *Sewage Descriptors: *Epidemiology, Public health, Diseases, Water pollution sources, Effluents, Biological treatment, Enteric bacteria, Waste water treatment.
Identifiers: *Entero viruses, *Poliovirus, Berlin

(Germany).

The presence of enteroviruses was detected in a volume of raw sewage as small as 0.1 ml in summer and 0.5 ml in winter. Adolescents during the summer appeared to be the maximum of causative agents. A relationship was indicated between outbreaks of epidemics and the virus density in the sewage. Purification of sewage in Imhoff tanks, percolating filters, and secondary sedimentary tanks eliminated only a small percentage of viruses. Tests conducted in an assembly of an oxidation ditch, secondary sedimentation tank, and a tower type percolating filter indicated reduction by approximately one decimal the density of attenuated type I poliovirus. Sewage discharged into water used for drinking or swimming should be subjected to disinfection during the warmer portion of the year. (Wilde-Wisconsin) W71-07884

THERMOSTABILITY OF LITTORINA MOL-LUSKS AS RELATED TO ENVIRONMENTAL CONDITIONS OF DIFFERENT SPECIES (IN RUSSIAN).

Akademiya Nauk SSSR, Vladivostok. Institut

A. D. Konev

Zhurnal Obshchei Biologii, Vol 31, No 3, p 337-341, 1970. 4 fig, 2 tab, 7 ref.

Descriptors: *Mollusks, *Temperature, *Mortality, Resistance, Salinity. Identifiers: *Thermostability, *Littorina, Amur Bay, Sea of Japan.

Test organisms, including Littorina brevicula, L mandshurica, and L kurila, were subjected to different levels of temperature for ten minutes or longer periods. 50% population mortality was accepted as the criterion of thermostability. The

recording of mortality was extended to 15 days follecording or mortality was extended to 15 days following the transfer of the test mollusks into water of 22C and 2.9% salinity. The critical temperature for L mandshurica was 43C and for L brevicula 46C. The maximum aplitude of thermostability was exhibited by eurybionic species possessing high degree of salinity tolerance. (Wilde-Wisconsin) W71-07888

RELATION OF THE PHYTOPLANKTON TO TURBULENCE AND NUTRIENT RENEWAL IN CASCO BAY, MAINE,

Woods Hole Oceanographic Institution, Mass. Edward M. Hulburt, and Nathaniel Corwin. Journal Fisheries Research Board of Canada, Vol 27, No 11, p 2081-2090, 1970. 4 fig, 4 tab, 30 ref.

Descriptors: *Phytoplankton, *Turbulence, *Nutrients, *Distribution, Maine, Diatoms, Nitrates, Temperature, Light, Phosphates, Sea water, Bays, Inflow, Currents (Water), Temporal distribution, Spatial distribution.

Identifiers: *Casco Bay (Maine), Thalassiosira nor-denkinddii Chaetocerus socialis Chaetocerus de-

denskioldii, Chaetoceros socialis, Chaetoceros debilis, Skeletonema costatum, Leptocylindrus minimus, Rhizosolenia delicatula, Guinardia flac-

Distributions of phytoplankton and nutrients in Casco Bay (Maine) evidenced by abundance of diatoms from late winter to end of summer, are affected by the bay's hydrographic features. Nutrient content of the water, particularly nitrate, is depleted during spring by the algal populations except in deep water at bay's entrances. Here appreciable quantities of nitrate persist into midsummer. Influxes of deep water may carry them inward and mix them upward, although the change from spring diatoms, Thalassiosira and Chaetoceros, to Skeletonema is considered to depend on temperature and light changes. Phytoplankton extended downward to 30 meters at the bay entrances, but its in situ growth was restricted to depths closer to the surface due to the turbidity. Its abundance must depend in early spring on the quantity of nutrients present and renewed from deep water. Both phosphate and nitrate concentrations decreased in surface waters during spring. The continued abundance of Skeletonema costatum through summer shows the distinctive effect that enhanced turbulence and concomitant nutrient renewal may have on the flora. This seasonal diatom abundance is important to filter-feeding animals, for mussles and clams occur between islands. (Jones-Wisconsin) W71-07889

ECOLOGY, COMPETITION, AND COENOLOGY OF REED (PHRAGMITES COMMUNIS L) AND THE TAXONOMY OF PHRAGMITETEA (IN GERMAN),

Eotvos Lorand Univ., Budapest (Hungary). Botanijus Kertje. A. Borhidi.

English summary. Acta Botanica Academiae Scientiarum Hungaricae, Vol 16, No 1-2, p 1-12, 1970. 5 fig, 1 tab, 35 ref.

Descriptors: *Aquatic plants, *Plant ecology, *Aerobic conditions, *Alkaline water, Aquatic habitats, Cattails, Competition, Environmental effects, Limiting factors, Brackish water, Marshes, fects, Limiting radion.
Ecological distribution.
*Reeds, *Phragmites communis,

Identifiers: *Reeds, *Phragmites
*Typha angustifolia, Glyceria maxima.

Ecological amplitude and coenological niche of the common reed, Phragmites communis were studied. The distribution of this plant is delineated by osmotic pressure of water and activity of anaerobic processes expressed by oxygen consumption. The intensity of anaerobic processes also decides the outcome of competition between Phragmites and cattails, Typha angustifolia, the latter being more tolerant of stagnant conditions. As the coenological role of the reed exceeds the framework of Phragmitetea (Brackrohrichte), a suggestion is made to distinguish reeds growing in alkaline and brackish waters. (Wilde-Wisconsin) W71-07893

PHOSPHORUS IN WATER AND WASTE WATER-AN ANNOTATED SELECTED BIBLIOGRAPHY, North Carolina Univ., Chapel Hill. Waste water

Research Center. For primary bibliographic entry see Field 05B. W71-07894

LARODAN FOR CLEANING OILED SEABIRDS. Goteborg Univ. (Sweden). Inst. of Medical Biochemistry; and Goteborg Univ. (Sweden). Inst. of Physiological Botany. Kare Larsson, and Goran Odham.

Marine Pollution Bulletin, Vol 1 (NS), No 8, p 122-

123, Aug 1970. 1 fig, 2 tab.

Descriptors: *Birds, *Waterfowl, *Detergents, *Oil, *Oily water, *Emulsifiers, *Rehabilitation, Water pollution effects, Water pollution treatment, Mallard duck, Geese (Wild), Shore birds, Wading birds, Water birds, Cleaning, Treatment, Gas chromatography, Biochemistry, Chemical properties, Inhibition, Toxins, Toxicity, Poisons, Swans.

Identifiers: *Seabirds, *Feather wax, *Preening wax, *Larodan, Anas sp., Wax.

The preen gland wax of several seabirds is composed of monoesters of methylated long-chain fatty alcohols and fatty acids, but the combinations are apparently species-specific. Complex combinations of components are found, e.g. the wax of the common mallard (Anas platyrhynchos) may contain up to 450 different compounds. Oil impairs water repellancy and heat insulation properties of the plumage, and impairs flying and feeding ability. Detergents remove feather wax, and no seabird can be returned to its natural environment until waxes are replaced. Larodan 127, a lipid-containing cleaning agent, was used to remove Shell talpa oil 30 from ducks. After 8-10 days, swimming ability was restored, which compares favorably with other cleaning agents. (LeGore-Washington) W71-07896

SUB-LETHAL EFFECTS ON LIVING ORGAN-

British Museum of Natural History, London (England). J. David George.

Marine Pollution Bulletin, Vol 1 (NS), No 7, p 107-109, July 1970, 22 ref.

Descriptors: *Water pollution effects, *Water pollution treatment, *Oily water, *Metals, *Pesticides, *Bioassay, *Annelids, *Detergents, *Emulsifiers, Oil, Aldrin, DDT, Dieldrin, Organophosphorous pesticides, Carbamate pesticides, Food chains, Heavy metals, Solvents, Carriers, Organic compounds, Pesticide residues, Toxicity, Toxins, Poisons, Worms.

Identifiers: *Polychaetes, *Organic solvents, BP 1002, Essolvene, Corexit 7664, Biomagnification, Lead, Silver, Zinc, Mercury, Cirratulus sp., Cirriformia sp., Fawley Southampton, Kerosene.

The sub-lethal effects are generally reviewed of oil, oil dispersants, pesticides and metals on the marine near-shore environment. Original research with two polychaetes, Cirratulus cirratus and Cirriformia tentaculata, is also described. Fuel oil spilled at Fawley, Southampton, England apparently had no effect on mortality or spawning of these polychaetes. Worm populations were affected, however, by Essolvene, which was used to clean installations in the area. Laboratory experiments determined that worms never recovered from high sub-lethal doses of BP 1002 and Essolvene, but that they could withstand 100,000 ppm of water soluble Corexit 7664. (LeGore-Washington) W71-07897

SOME SUB-LETHAL EFFECTS OF BP 1002 UPON MARINE GASTROPOD MOLLUSCS, University of Strathclyde, Glasgow (Scotland). Dept. of Biology. E. J. Perkins.

Journal of the Devon Trust, No 19, p 794-798, Dec 1968, 3 tab, 3 ref.

Descriptors: *Bioassay, *Lethal limit, *Toxicity, *Emulsifiers, *Water pollution effects, *Water pollution treatment, *Growth rates, *Detergents, Toxins, Resistance, Poisons, Gastropods, Mollusks, Snails, Oil, Oil wastes, Oily water, Water pollution sources, Mortality, Pollutants, Treatment, Surfac-

Identifiers: *PB 1002, *Oil spills, *Oil spill treatment, *Growth inhibition, *Torrey Canyon, TLm, Littorina sp., Nucella sp., Buccinum sp., Concentrations, Dose, Tarsolvent (Petrofina).

PB 1002 is an oil emulsifier, and was used to disperse the Torrey Canyon oil spill in 1967. Shortterm TLm values for several organisms against BP 1002 were subsequently determined, but these yield inadequate information. The long-term mortality of animals exposed to BP 1002 and returned to their environment was studied with several gastropods, principally Littorina littorea, L. saxatilis and Nucella lapillus. Mortality was induced by exposure to concentrations considerably lower than the previously determined 24 hr LC50. Growth inhibition of L. littorea was noted at 7.5 ppm, which is 1/400 the 24 hr LC50. Growth inhibition may be indefinitely detected as a result of a single exposure to a pollutant, and such inhibition may require reformation of the definitions of pollution. (LeGore-Washington) W71-07898

THE EFFECTS OF VARYING CONCENTRA-TIONS OF NUTRIENTS, CHLORINITY, AND DISSOLVED OXYGEN ON POLYCHAETOUS

California State Coll., Long Beach. Dept. of Biolo-

Donald J. Reish.

Water Research, Vol 4, p 721-735, 1970. 13 tab,

Descriptors: *Bioassay, *Pollutant identification, *Water pollution effects, *Toxicity, *Environmental sanitation, *Sewage effluents, *Lethal limit, *Annelids, *Bioindicators, Phosphates, Nitrates, Silicates, Chlorine, Dissolved oxygen, Impaired water quality, Pollutants, Water pollution, Indicators, Investigations, Water pollution sources, Toxins, Aquatic environment, Disposal, Treatment facilities, Wastes, Chemical wastes, Inorganic compounds, Fertilizers.

Identifiers: *Polychaetes, Concentrations, TLm, Nereis sp., Neanthes sp., Dorvillea sp., Capitella sp.

The effects of varying concentrations of known environmental variables around marine domestic sewer outfalls were studied on four species of polychaetous annelids which have been employed as indicators of varying degress of marine pollution (Nercis grubei, Neanthes arenaceodentata, Dorvillea articulata and Capitella capitata). The variables included increased concentrations of nitrates, phosphates and silicates, and decreased concentrations of chlorinity and dissolved oxygen. These factors were measured individually, the 3 nutrients together, and all 5 variables together. Data were expressed in the form of 28 day TLm values. N. grubei, the healthy zone indicator, was the most sensitive sp. studied. In general, the tolerances of the two semi-healthy zone indicators and the polluted zone indicator were similar. Comparisons of the TLm values with the concentrations of these factors present at the bubble of the Orange County, California outfall showed that these four species would be unaffected directly by the altered condi-tions in the waste discharge. (LeGore-Washington) W71-07899

SPAWNING OF THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA, AT EXTREME PH

Bureau of Commercial Fisheries, Milford, Conn. Biological Lab.

Anthony Calabrese, and Harry C. Davis. The Veliger, Vol 11, No 3, p 235-237, 1968. 1 fig, 1 tab, 8 ref.

Descriptors: *Oysters, *Hydrogen ion concentra-tion, *Spawning, Aquatic animals, Benthos, Com-mercial shellfish, Mollusks, Acidity, Alkalinity, Larvae, Bioassay, Laboratory tests, Gametocides, Viability, Connecticut. Identifiers: *Crassostrea virginica, American oyster, Gametes, Milford (Conn).

Oysters were induced to spawn at various pH levels by use of techniques developed at the Milford laboratory. Successful spawning occurred at pH 6.0 to 10.0. After exposure to test pH levels for varying periods, experimental gametes were mixed with gametes from oysters spawned at normal pH (approximately 7.8). At pH 6.0 and 10.0, gametes lose their viability after 2-4 hr. The viability of oyster gametes spawned at normal pH levels also decreases over time, but the decrease is more abrupt at the extreme pH levels of 6.0 and 10.0. (LeGore-Washington) (LeGore-Washington) W71-07900

STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY-V. A TRIAL TO DECREASE THE TOXICITY OF HEAVY METAL IONS BY THE ADDITION OF COMPLEXING AGENTS (IN JAPANESE), Universidad Autonoma del Estado de Baja, Califor-

nia (Mexicali).

Kenji Tabata, and Katsuo Nishikawa. English abstract. Bulletin of Tokai Regional Fisheries Research Laboratory, No 58, p 255-264, May 1969. 1 fig, 4 tab, 10 ref.

Descriptors: *Heavy metals, *Water pollution treatment, *Copper, *Waste treatment, *Sewage treatment, *Chemical precipitation, Toxicity, Water pollution control, Mollusks, Oysters, Bioassay, Ions, Ion transport, Competition, Sodium compounds, Waste disposal, Mining engineering, Chemical wastes, Industrial wastes.

Identifiers: *Mercury, *EDTA, *Complexing agents, Metals, Cations, Precipitates, Green oysters, Sodium citrate, Sodium thiosulfate.

The potential use was studied of complexing agents to decrease toxicity of industrial wastes. They found a remarkable decrease in toxicity when sodium citrate or EDTA was added to copper mine wastes, and when sodium thiosulfate was added to a mercury pesticide. Cu-EDTA is more stable to bacterial decomposition than Cu-citrate. Also, Cucitrate and Cu-thiosulfate are more readily concentrated by aquatic animals than is Cu-EDTA. This method might be useful as an adjunct to secondary treatment of wastes containing small quantities of toxic heavy metals, but that EDTA is probably too expensive. Such treatment, might be effective in prevention of 'green' oysters. (LeGore-Washing-W71-07901

2-PIPERIDINO-8-MERCAP-STUDIES ON TOADENINE, A POTENT INHIBITOR CLEAVAGE IN ECHINODERM EMBRYOS, Sloan-Kettering Inst. for Cancer Research, New

York; and Mount Desert Island Biological Lab., Salisbury Cove, Me.

C. W. Young, F. J. Hendler, E. Simmel, and D. A.

Experimental Cell Research, Vol 60, p 45-53, 1970. 4 fig, 4 tab, 10 ref.

Descriptors: *Inhibition, *Inhibitors, *Metabolism, Biochemistry, Chemcontrol, Enzymes, Retardants, Eggs, Embryonic growth stage, Incubation, Competition, Pathology, Fertility, Resistance.

Group 5C-Effects of Pollution

Identifiers: *Cleavage, *Echinoderms, *Mercaptoadenine derivatives, Sand dollar, Development, DNA, PMA, Karyokinesis.

Several 8-mercaptoadenine derivatives inhibited pronuclear fusion, karyokinesis and cleavage in the sand dollar embryo. The most potent of these 2-piperidino-8-mercaptoadenine (PMA) prevented cleavage when present at a concentration of 0.1 ug/ml or greater. At cleavage-inhibitory concentra-tions, PMA did not inhibit synthesis of protein; drug effects upon synthesis of DNA seemed to be secondary to changes in karyokinesis. The microscopic and biochemical effects of PMA closely resembled those of colchicine; they differed significantly from the effects produced by dinitrophenol, usnic acid, cyclohexamide, beta-mercaptoethanol and dithiothreitol. Both 6-NH2 and 8-SH substitutions on the purine molecule were necessary for cleavage inhibitory potency. Marginal protection against cleavage inhibition was afforded by mercaptopurines, mercaptopurine ribosides and cysteine, but not by purines, purine ribosides, methylmercaptopurine or cystine. (LeGore-Washington) W71-07902

SOME EFFECTS OF DETERGENTS IN THE MARINE ENVIRONMENT,

University of Strathclyde, Glasgow (Scotland). Dept. of Biology.

E. J. Perkins.

Chemistry and Industry, p 14-22, 3 Jan 1970. 5 fig. 10 tab, 4 ref.

Descriptors: *Bioassay, *Lethal limit, *Toxicity, *Emulsifiers, *Water pollution effects, *Water pollution treatment, *Growth rates, *Detergents, Toxins, Aromatic compounds, Resistance, Poisons, Gastropods, Mollusks, Snails, Oil, Oil wastes, Oily water, Water pollution sources, Mortality, Pollutants, Treatment, Surfactants.

Identifiers: *BP 1002, *Oil spills, *Oil spill treatment, *Growth inhibition, *Torrey Canyon, *Tarsolvent (Petrofina), *Slickgone (Dasic), Littorina sp., TLm, Nucella sp., Buccinum sp., Concentrations, Dose.

This study concerned the physiological consequences of apparently sub-lethal concentrations of detergents. Three species of gastropods (Littorina spp. and Nucella sp.) were exposed to severe and to graded concentrations of various detergents (BP 1002, octyl phenol ethoxylate surfactant (DS 4359), Dasic 'Slickgone,' or Petrofina 'Tarsolvent'), and were returned to a natural environment. In all cases, considerable delay was required for full development of the mortality pattern. Seven day in-terpretations of effects were found inadequate, and effects were still evident as long as 22 weeks postexposure. Both mortality and growth inhibition may be significant at very low concentrations, while inactivation may have more effect on survival than do TLm concentrations. (LeGore-Washington) W71-07903

ORGANOCHLORINE INSECTICIDE RESIDUES IN FISH (NATIONAL PESTICIDE MONITOR-

Bureau of Sport Fisheries and Wildlife, Fort Collins; and Bureau of Sport Fisheries and Wildlife, Washington, D.C.

Croswell Henderson, Wendell L. Johnson, and Anthony Inglis.

Pesticides Monitoring Journal, Vol 3, No 3, p 145-171, Dec 1969, 1 fig. 4 tab, 23 ref.

Descriptors: *Pesticide residues, *Chlorinated hydrocarbon pesticides, *Monitoring, *Water pollution effects, Pesticides, Residues, Bioassay, Fish physiology, Pollutants, DDT, Dieldrin, Aldrin, Endrin, Heptachlor, Agricultural chemicals, Food chains, Pesticide drift, Public health, Chromatography, Analytical techniques, Chemical analysis, Data collections, Fish diseases.

Identifiers: DDE, TDE, Lindane, Heptachlor epoxide, Chlordane, Toxaphene, Column chromatog-

As a part of the National Pesticide Monitoring Program, fish were collected from 50 sampling stations located in the Great Lakes and in major river basins throughout the United States. Three composite samples, consisting of 5 adult fish of each of 3 species, were collected at all stations during the spring and fall of 1967 and 1968. The samples were analyzed for residues of 11 organochlorine insecticides. DDT and/or metabolites were found in 584 states. of the 590 composite samples, with values ranging to 45 ppm (mg/kg wet weight, whole fish). Dieldrin was found in 75% of the samples, with values ranging upward to nearly 2 ppm. Other organochlorir insecticide residues were found in fewer samples, but some had fairly high residue levels. Relatively high residues of DDT and metabolites, dieldrin, heptachlor, heptachlor epoxide, and chlordane were found consistently during all sampling periods at some stations. (LeGore-Washington) W71-07904

HISTOPATHOLOGICAL EFFECTS OF THE IN-SECTICIDES, HEPTACHLOR AND NICOTINE, ON THE GILLS OF THE CATFISH, HETEROP-NEUSTES FOSSILIS.

Kalyani Agricultural Univ. (India). Dept. of Zoolo-

gy. Sushil Kanta Konar.

Japanese Journal of Ichthyology, Vol 15, No 4, p 156-159, 1969. I fig, 6 ref.

Descriptors: *Heptachlor, *Animal pathology, *Respiration, Fish physiology, Catfish, Fish behavior, Fish toxins, Fishkill, Toxicity, Pesticide toxicity, Water pollution effects, Insecticides. Identifiers: *Nicotine, *Histopathological effects, *Fish gills, Mucus, Respiratory distress, Heteropautor foreilie.

The fishes exposed to 1.0 ppm of heptachlor and 3.2 ppm of nicotine at room temperature (18.89-23.89C) died within 19 to 44 hours. The fishes exhibited acute respiratory distress with both insecticides. The gills of fishes exposed to heptachlor were found coated with a layer of mucus, but no such covering was found on the gills of those which died in nicotine. The surface cells of the gill fila-ments of fishes killed by heptachlor showed disintegration, rupture, vacuolation, karyorrhexis, and extrusion and degeneration of muclei and cytoplasm. The number of mucous cells in these gills was increased which resulted in the secretion of mucus over them. With nicotine, only the basal parts of a few gill filaments were damaged. Injury with heptachlor was due to surface irritation rather than absorption of the poison through the gills. Due to paralytic action induced by nicotine, the fishes failed to renew water of their opercular chamber which resulted in asphyxiation and finally death. (Sjolseth-Washington)

PESTICIDES IN THE ANTARCTIC,

Pennsylvania State Univ., University Park. J. L. George, and D. E. H. Frear. Journal of Applied Ecology, 3 (suppl), p 155-167, June 1966, 3 ref, 6 tab.

Descriptors: *DDT, *Pesticides residues, *Antarctic, Antarctic Ocean, Gas chromatography, Snow, On-site data collections, Pesticide drift. Identifiers: *Weddell Seals, *Penguins, Tissue analyses, Skua, Trematomus bemacchi, Rhigophila dearboni, DDE

The Antarctic was investigated for the presence of pesticides. Samples of snow soils, fauna and flora were collected. Measurements able to detect 0.0005 ppm in water, 0.005 ppm in animal tissues, detected no residues in fifteen snow samples nor in seven samples of invertebrates from four phyla. Residues were found in vertebrates: only in one of eight samples of three fish species and none in one

Emperor Penguin, but four of sixteen Adelie Penguin, four of sixteen Weddell Seals and fifteen of sixteen Skuas contained residues in one or more tissues. Maximum residues in ppm wet weight were: 0.44 DDT in the fish Rhigophila, 0.18 DDT in Adelie Penguins, 0.15 DDT in Weddell Seals, and 2.8 DDE in Skuas. Pesticides, therefore, occur in the Antarctic, thousands of kilometers from the nearest point of use. The residues are much higher in the fatty issues of vertebrate predators than in the general environment. (Sjolseth-Washington) W71-07906

MORTALITY AT SOUTHEND,

British Museum of Natural History, London (En-

gland).
J. David George.
Marine Pollution Bulletin, Vol 1 (NS), No 9, Sept 1970, 1 p.

Descriptors: *Oil, *Oily water, *Detergents, *Emulsifiers, *Water pollution effects, Mussels, Shellfish, Annelids, Snails, Gastropods, Mollusks, Crabs, Water pollution treatment, On-site investigations, Evaluation, Pollution (Water), Mortality, Pollutants, Toxins, Poisons, Mud flats. Identifiers: *BP 1002, *BP 1100, *Polychaetes, *Oil spills, Mytilus edulis, Ulva sp., Enteromorpha

sp., Fucus sp., Balanus sp., Littorina sp., Carcinus sp., Arenicola sp., Neanthes sp., Nerine sp., Nephtys sp., Cockles.

On July 27, 1970 a pipeline at Mobil's Coryton refinery in the Thames Estuary was fractured, and 400,000 kg of oil was released into the sea. Dispersant spray and a dispersant/freshwater mixture were used for cleaning operations. Extensive mortalities of several species of polychaetes, snails, a species of cockle, mussels and crabs occurred on intertidal muddy sand flats within 100 m of the shore. Seaweeds on the seawall were damaged by the dispersants, but the extent of damage is unclear. Mortality may have been abetted, or even caused, by the large quantities of freshwater used to flush oil-affected areas. (LeGore-Washington) W71-07907

OIL POLLUTION. DAMAGE OBSERVED IN TROPICAL COMMUNITIES ALONG THE AT-LANTIC SEABOARD OF PANAMA, Smithsonian Institution, Washington, D.C. Dept. of Invertebrate Zool; and Bermuda Biological Station,

St. George's West.

Klaus Ruetzler, and Wolfgang Sterrer.

Bioscience, Vol 20, No 4, p 222-224, Feb 15, 1970. 8 fig, 1 tab, 4 ref.

Descriptors: *Oil, *Oily water, *Water pollution effects, *Pollution (Water), *Biological communities, Coral, Mangrove swamps, Intertidal areas, Beaches, Estuaries, Mud flats, Mussels, Shellfish, Oysters, Snails, On-site investigations, Evaluation, Mortality, Pollutants, Turtles, Fuels, Gastropods. Identifiers: *Oil spills, *Bunker oil, *Diesel oil, Crassostrea sp., Rocky shores, Galeta Island, Canal Zone, Witwater, Caretta sp., Uca sp.

A brief survey was made of the effects of 20,000 barrels of diesel oil and Bunker C spilled offshore of Galeta Island, Canal Zone, when the tanker Witwater was wrecked in late 1968. Rocky shores, coral reefs, sandy beaches and mangrove areas were observed. Intertidal communities were most severely affected. This was particularly true of the mangrove areas, where intertidal algal and sedentary faunal communities were virtually destroyed. Species having to penetrate the air-water interface, such as turtles, were severely affected. The mangroves themselves were damaged, and the fiddler crab populations were decimated. Sandy shore meiofaunal populations were dramatically reduced, and rocky shore fauna was damaged. Subtidal coral was not obviously affected. Detergents were not used to clean the spill. (LeGore-Washington)

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

OIL SPILL IN TARUT BAY, SAUDI ARABIA, Marine Biological Association of the United Kingdom, Plymouth (England). Lab.

Molly Spooner. Marine Pollution Bulletin, Vol 1 (NS), No 11, p 166-167, Nov 1970. 1 fig.

Descriptors: *Oil, *Oily water, *Pollution (Water), *Water pollution effects, Coral, Mangrove swamps, Intertidal areas, Mud flats, Shellfish, Mollusks, Snails, Gastropods, On-site investigations, Evaluation, Resistance, Pollutants, Birds, Coastal

Evaluation, Acastante, Foliutants, Brus, Coastan marshes, Marshes, Marsh plants, Crabs, Worms, Annelids, Fishkill, Shrimp. Identifiers: *Oil spills, *Chronic pollution, Corexit 7664, Arabian crude oil, Saudi Arabia, Cor-morants, Limpets, Penaeid shrimp.

The biological effects were observed of a pipeline fracture in Tarut Bay, Saudi Arabia. Arabian crude oil (100,000 barrels), with an API gravity of 34.6 and low in aromatics, was lost, and Corexit 7664 was used to disperse oil slicks. Most crabs, bivalves, some limpets and several fish were killed, but some gastropods (Cerithium sp.) and tube worms seemed unaffected. Shoals of healthy 2-5 cm fish were seen. Mangrove trees were largely coated with oil, but three months later were recovering. The appearance after 3 months was a good deal better than expected. Mention is made of chronic oil pollution in the area. Bird life does not appear to be severely damaged. (LeGore-Washington)

INFLUENCES OF STRIP MINING ON THE HYDROLOGIC ENVIRONMENT OF PARTS OF BEAVER CREEK BASIN, KENTUCKY, 1955-66,

BEAVER CREEK BASIN, KENTUCKY, 1955-66, Geological Survey, Washington, D.C. C. R. Collier, R. J. Pickering, and J. J. Musser. For sale by Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$1.50. Geological Survey Professional Paper 427-C, 1970. 80 p, 37 fig, 41 tab, 17 ref.

Descriptors: *Strip mines, *Water pollution sources, *Water pollution effects, *Hydrogeology, *Kentucky, Rainfall-runoff relationships, Erosion, Sedimentation, Sediment yield, Aquatic life, Acid mine water, Sulfates, Hydrogen ion concentration. Identifiers: *Beaver Creek Basin (Ky).

Strip mining of coal in the Beaver Creek basin in south-central Kentucky has significantly increased the acidity and mineralization of surface and groundwater and increased the sediment content of streams in the mined area. These effects, in turn, have reduced or eliminated aquatic life in the streams. Influences of mining on the hydrologic enstreams. Influences of mining on the hydrologic en-vironment are limited largely to the Cane Branch basin and to Hughes Fork downstream from Cane Branch. Beaver Creek, 3 miles downstream from the mined area, is relatively unaffected. An ex-amination of the hydrologic data for a progressive change in runoff characteristics of Cane Branch that could be related to the history of mining in the basin failed to indicate any such change. There have been no significant changes in the occurrence and movement of groundwater in bedrock and spoil in the vicinity of the southwest spoil bank since observations began in 1958. (See also W71-07936 thru W71-07943) (Knapp-USGS) W71-07935

PRECIPITATION AND RUNOFF, Geological Survey, Washington, D.C.

J. A. McCabe. In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C5-C9, 1970. 5 p, 4 fig. 1 tab.

Descriptors: *Strip mines, *Acid mine water, *Rainfall-runoff relationships, *Kentucky, *Water pollution sources, Coal mines, Runoff, Data collections, Hydrologic data, Rain gages, Stream gages, Strip mine wastes, Path of pollutants. Identifiers: *Beaver Creek Basin (Ky).

The runoff characteristics of Cane Branch and Helton Branch basins of Kentucky were studied to re-late any observed differences between the two late any observed differences between the two basins to differences in their exposure to strip mining. The drainage basin of Cane Branch includes strip-mined areas, whereas the drainage basin of Helton Branch has not been disturbed by strip mining. There were measurable differences in runoff characteristics between the two basins, despite the characteristics between the two basins, despite the fact that similar percentages of annual precipitation go to runoff and evapotranspiration in each basin. Application of both flow-duration and annual-flood methods to analysis of stream hydrographs indicated that Cane Branch has greater peak flows per square mile of drainage area and more rapid changes in discharge, but Helton Branch has greater base flows. However, an examination of the hydrologic data for progressive change in runoff characteristics of Cane Branch that could be related to the history of mining in the that could be related to the history of mining in the area failed to indicate any such change. (See also W71-07935) (Knapp-USGS) W71-07936

GROUNDWATER,
Geological Survey, Washington, D.C.
H. T. Hopkins, and D. S. Mull.
In: Influences of Strip Mining on the Hydrologic
Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional
Paper 427-C, p C9-C14, 1970. 6 p, 4 fig.

Descriptors: *Strip mines, *Strip mine wastes, *Hydrogeology, *Groundwater movement, Water levels, Data collections, Hydrologic data, Aquifers, Recharge, Water pollution sources, Path of pollutants, Kentucky.

Identifiers: *Beaver Creek Basin (Ky).

The effects of mining on the occurrence, movement, and quality of groundwater were studied in the Cane Branch study area, Kentucky. Ground-water in the essentially unmined West Fork Cane Branch study area was also investigated to provide a basis for comparison. There has been no significant change in the occurrence and movement of groundwater in the vicinity of the southwest spoil bank since beginning of observations in the spring of 1958. Shallow groundwater in bedrock is recharged by precipitation and moves from topographically high areas to streams. Groundwater in the southwest spoil bank is recharged by direct in-filtration of precipitation and seepage from adjacent pools, and it discharges mostly eastward into tributaries drainage the spoil bank area. Fluctuations of the water table in the spoil bank are largely controlled by direct infiltration of precipitation during the winter-spring season, but they are strongly influenced by seepage from pools adjacent to the spoil bank during the summer-autumn season. The shape and slope of the water table in the spoil bank have not changed significantly since observations began in 1958. (See also W71-07935) (Knapp-USGS) W71-07937

GEOCHEMISTRY OF WATER,

Geological Survey, Washington, D.C. J. J. Musser, and R. J. Pickering.

In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C14-C30, 1970. 17 p, 9 fig, 7 tab.

Descriptors: *Strip mines, *Acid mine water, *Water pollution effects, *Water quality, *Path of pollutants, Surface waters, Streamflow, Water pollution sources, Hydrogeology, Su Geochemistry, Leaching, Erosion, Kentucky. Identifiers: *Beaver Creek Basin (Ky). Sulfates.

One of the environmental factors most obviously influenced by strip mining in the Cane Branch basin of Kentucky is the chemical composition of the water. Cane Branch is an acid stream because of strip mining. This report describes and evaluates (1) changes in the chemical composition of water in the Cane Branch study area, (2) the chemical

composition of water in nearby study areas unafcomposition of water in nearby study areas unaffected by mining, and (3) the general persistence of acid water downstream from the Cane Branch mining area. Although fluctuations of annual mean concentrations due to climatic variations have made it difficult to identify a definite trend during the period 1962-66, apparently there was little change in the rate of chemical weathering or in the chemical composition of the water in Cane Branch during the last 5 years of the study. As the acid mine drainage from the Cane Branch area moves downstream, it is diluted and neutralized by inflow from streams containing bicarbonate alkalinity. downstream, it is diluted and neutralized by inflow from streams containing bicarbonate alkalinity. The effects of the mine drainage are almost unde-tectable at the point where water from Little Hur-ricane Fork enters Beaver Creek, and Beaver Creek below this point has a slightly acid pH like that of neighboring streams unaffected by acid mine drainage. (See also W71-07935) (Knapp-USGS) W71-07938

EROSION AND SEDIMENTATION, Geological Survey, Washington, D.C. C. R. Collier.

C. K. Collier.

In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C31-C46, 1970. 16 p, 12 fig, 1 tab.

Descriptors: *Strip mines, *Strip mine wastes, *Erosion, *Sedimentation, *Sediment yield, Provenance, Vegetation effects, Gully erosion, Sheet erosion, Stream erosion, Kentucky. Identifiers: *Beaver Creek Basin (Ky).

The sediment characteristics of Cane Branch, Kentucky, were greatly affected by strip mining in the headwaters of the stream. The sediment yield from unmined areas averaged about 25 tons per square mile per year, whereas from 1959 to 1962, erosion of the spoil banks in the Cane Branch basin resulted in an average yield of more than 27,000 tons per square mile of spoil bank per year. Sheet erosion on the gently sloping top of the spoil bank decreased appreciably, whereas loss of material by gully erosion increased with time. Erosion of abandoned coal haul roads in the Cane Branch hasin The sediment characteristics of Cane Branch, Kendoned coal haul roads in the Cane Branch basin was severe in places where the roads had steep grades. Since the fall of 1959, when mining ended on the northeast side of Cane Branch, there has been no overall reduction in the amount of sediment discharged by Cane Branch. However, the particle size of the sediment in transport and in the channel and flood-plain deposits of Cane Branch has become coarser since the 1959 mining. (See also W71-07935) (Knapp-USGS) W71-07939

STREAM BOTTOM FAUNA, Kentucky Dept. of Fish and Wildlife Resources,

J. P. Henly.

In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C46-C49, 1970. 4 p, 3 fig, 3 tab.

Descriptors: *Water pollution effects, *Acid mine water, *Strip mines, *Strip mine wastes, *Benthic fauna, Kentucky, Aquatic life, Benthos, Mayflies, Sampling, Water quality, Toxicity, Identifiers: *Beaver Creek Basin (Ky).

Strip mining of coal in the Cane Branch Basin of Beaver Creek, Kentucky affected the invertebrate bottom fauna of both Cane Branch and its receiving stream, Hughes Fork. Acid water and sediment that were subsequently transported to the stream from the strip-mined areas resulted in a loss of invertebrate bottom fauna in Cane Branch and Hughes Fork. In spite of a limited repopulation of benthic fauna observed in Hughes Fork in 1964, this loss can be expected to persist in both streams for many years. Not until the strip-mined area is healed and stream habitat restored will aquatic life return to the two streams in any great numbers. (See also W71-07935) (Knapp-USGS)

Group 5C—Effects of Pollution

W71-07940

FISH POPULATION, Bureau of Sport Fisheries and Wildlife, Washington, D.C.

J. R. Sheridan.

In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Ken-tucky, 1955-66, Geological Survey Professional Paper 427-C, p C50-C53, 1970. 4 p, 1 fig, 4 tab.

Descriptors: *Water pollution effects, *Acid mine water, *Strip mines, *Toxicity, *Fishkill, Kentucky, Fish, Sampling, Hydrogen ion concentration, Water quality, Fish populations. Identifiers: *Beaver Creek Basin (Ky).

Fish life disappeared from Cane Branch, Pennsyl-Fish life disappeared from Cane Branch, Pennsylvania, when its water became highly acid as a result of strip mining of coal during the period 1955-56. The fish population in Hughes Fork, which received the acid water from Cane Branch, was severely restricted. Differences in pH among the streams are very evident, especially the contrast between Cane Branch and the unaffected streams. The pH of 3.2 measured in Cane Branch is lethal to fish pH values of 5.5 and 6.0 for the affected part fish; pH values of 5.5 and 6.0 for the affected part of Hughes Fork suggest that the stream is not toxic to all species; yet fish were not present. Some recovery apparently occurred by 1964 in Hughes Fork just above Freeman Fork, but it did not result in a fishable population. (See also W71-07935) (Knapp-USGS) W71-07941

MICROBIOLOGY OF STREAMS,

Kentucky Univ., Lexington. Dept. of Microbiology. R. H. Weaver, and H. D. Nash.

In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C53-C57, 1970. 5 p, 1 fig, 4 tab.

Descriptors: *Aquatic microorganisms, *Acid mine water, *Strip mines, *Water pollution effects, *Kentucky, Sulfur bacteria, Water quality, Sulfates, Hydrogen ion concentration, Algae, Bacteria, Water pollution sources.
Identifiers: *Beaver Creek Basin (Ky).

Drainage from strip-mined areas appears to have affected the microflora of Cane Branch, Kentucky. Chemical oxidation of pyritic compounds found extensively in spoil banks has resulted in the formation of ferrous sulfate and sulfuric acid. This appears to have led to the establishment in the mined part of the Cane Branch study area of Ferrobacillus ferrooxidants, which contributes to the production of acid entering the stream. The lowering of pH has enabled this organism to exist throughout the stream from the vicinity of the spoil banks downstream to the gaging station. Standard plate counts show a much smaller number of saprophytic bacteria in Cane Branch than in Helton Branch. This, too, can be attributed to the low pH of Cane Branch. The filamentous fungi are more numerous and diversified in Cane Branch than in Helton Branch. In addition, the yeast, Rhodotorula, which is associated with increased acid production by Thiobacillus ferrooxidans, and the alga Bumilleria were isolated only from Cane Branch. (See also W71-07935) (Knapp-USGS) W71-07942

TREE GROWTH,

Geological Survey, Washington, D.C. R. S. Sigafoos.

R. S. Sigatoos.
In: Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955-66, Geological Survey Professional Paper 427-C, p C57-C59, 1970. 3 p, 3 fig, 1 tab.

Descriptors: *Water pollution effects, *Strip mines, *Vegetation effects, *Trees, *Kentucky, Acid mine water, Sedimentation, Soil erosion, Land clearing, Water quality, Mine wastes. Identifiers: *Beaver Creek Basin (Ky). The net effect of strip mining upon the forests in the Cane Branch basin, Kentucky is negative. The area mined was cleared of trees at the time of mining, and after a recovery period of 10 years did not support the number of trees that a comparable area of abandoned cultivated land supported. Furthermore, some trees that were not destroyed at the time of mining subsequently died probably more, some trees that were not destroyed at the time of mining subsequently died, probably because of burial by sediment, and other trees may have had their growth inhibited as a result of irrigation by mine drainage. (See also W71-07935) (K-napp-USGS) W71-07943

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC, REPORT OF PROGRESS, JUNE 1969 THROUGH JUNE 1970, Washington Univ., Seattle. Dept. of Oceanography. Clifford A. Barnes.

Service as RLO-1725-180, \$3.00 in paper copy, \$0.95 in microfiche. Progress Report, July 10, 1970. 20 p, 8 fig, 1 tab, 3 append. USAEC Contract AT (45-1)-1725.

Descriptors: *Columbia River, *Water chemistry, *Aquatic microbiology, *Aquatic environment, Water pollution effects, Sedimentation, Water quality, Hydrology, Pacific Ocean.

Research conducted on the Columbia River effects in the Northeast Pacific Ocean by the Department of Oceanography of the University of Washington from June 1969 through June 1970 is summarized. from June 1969 through June 1970 is summarized.
The subject areas covered include (1) the physical,
(2) the chemical-geochemical-geologicalgeophysical, and (3) biological aspects of the
Columbia River system. The ocean area of primary
interest to the project extends from San Francisco
Bay at 38 degrees N to Vancouver Island at 49 degrees N, seaward some 600 km, and into the Strait of Juan de Fuca. (Knapp-USGS) W71-07969

DEMONSTRATING THE EFFECTS OF NUTRIENTS IN BIO-OXIDATION POND RECEIVING STREAMS, Oklahoma Univ., Norman. Bureau of Water Resources Research.

George W. Reid, Leale E. Streebin, and Oliver T.

Available from the National Technical Information Service as PB-199 269, \$3.00 in paper copy, \$0.95 in microfiche. Mar 1971. 72 p, 16 fig, 10 tab, 49 ref, append. Environmental Protection Agency Program 16010--03/71, Demonstration Grant WPD-98-01-66.

Descriptors: *Eutrophication, *Oxidation lagoons, *Sewage lagoons, Biodegradation, *Nutrients, Algae, *Degradation (Stream), Water pollution effects, Waste water treatment, Cyanophyte, Englenophyta, Organic loading.

This study considered the receiving stream as an integral part of the bio-oxidation pond method of treatment with the objective being to provide a better understanding of the bio-oxidation pond receiving stream system. As representative of this 'real world' situation with all of its variables, five existing central Oklahoma bio-oxidation ponds which had diverse loadings and designs were utilized. ized. By observing these systems under varying climatic conditions, the effects of the bio-oxidation pond nutrients along with other pollutional parameters which were discharged into intermittent receiving streams were evaluated. Except for scouring, bio-oxidation ponds and bio-oxidation pond receiving streams were found to behave essentially the same as the streams became a continuation of the pond. In addition to making biochemical adjustments, the streams lost much of their biological identity and assumed characteristics more closely associated with the biological loadings from the pond effluent. The most persistent algae in the systems were the flagellates (Euglenophyta) and the blue-green algae (Cyanophyta) as these plankters had little difficulty

making the transition from their acclimated life in the pond to the stream. W71-07973

ON BIOLOGICAL NITROGEN FIXATION IN NATURE, PARTICULARLY IN BLUE-GREEN

For primary bibliographic entry see Field 02H. W71-08024 Carlsberg Laboratoriet, Copenhagen (Denmark).

RECORDS OF TUBIFICIDAE (OLIGOCHAETA) FROM THE GREAT LAKES (L MALAREN, L VATTERN, AND L VANERN) OF SWEDEN, Uppsala Univ. (Sweden). Dept. of Zoology.

Goran Milbrink.

Archiv fur Mikrobiologie, Vol 67, No 1, p 86-96, 1970. 3 fig, 24 ref.

Descriptors: *Oligochaetes, *Lakes, *Tubificids, Water pollution, Indicators, Profundal zone, Sampling, Stratification.

Identifiers: Lake Malaren (Sweden), Lake Vattern (Sweden), Lake Vanern (Sweden), Tubifex templetoni, Tubifex tubifex, Euilyodrilus heuscheri, Euilyodrilus bedoti, Euilyodrilus vejdovskyi, Euilyodrilus bedott, Euilyodrilus vejdov-skyi, Euilyodrilus moldaviensis, Euilyodrilus ham-moniensis, Bothrioneurum vejdovskyanum, Au-lodrilus peuriseta, Aulodrilus limnobius, Aulodrilus pigueti, Tubifex ignotus, Limnodrilus clapareanus, Psammoryctes albicola.

The primary aim of this study was to acquire more information about the family Tubificidae in Sweden on which only a few scattered observations were recorded—a shortcoming to applied limnology; several species are reliable indicators of water pollution, especially when occurring in characteristic combinations. The tubificid values mostly refer to the profundal, where heterogeneity in material-caused, for instance, by small inflows, local organic accumulations, and exposition--is less pronounced. Where representatives of the families Naididae, Enchytracidae, and Lumbriculidae oc-Naididae, Enchytracidae, and Lumbriculidae oc-curred in the samples, these were recorded as well. So far 21 species of Tubificidae are known in Swedish habitats. All of them have been reported in the three great lakes--Malaren, Vattern, and Vanern. The following eight species are recorded here, apparently for the first time, from Scandinavi-an fresh waters. Tubifex templetoni, Euilyodrilus heuscheri (somewhat uncertain), E bedoti, E vej-dovskyi. F. moldaviensis. Bothrioneurum veidovdovskyi, E moldaviensis, Bothrioneurum vejdovskyanum, Aulodrilus limnobius, and A pigueti, Tubifex ignotus and Limnodrilus claparendeanus are new to Sweden. Psammoryctes albicola and Au-lodrilus pluriseta have been recorded in Sweden only once before. Information is given on distribution of nine other Tubificidae, previously known to exist in that country. (Jones-Wisconsin) W71-08025

POPULATION DYNAMICS AND SALINITY TOLERANCE OF HYADESIA FUSCA (LOH-MAN) (ACARINA, SARCOPTIFORMES) FROM BRACKISH WATER ROCKPOOLS, WITH NOTES ON THE MICROENVIRONMENT IN-

SIDE ENTEROMORPHA TUBES, Stockholm Univ. (Sweden). Asko Lab.; and Stockholm Univ. (Sweden). Dept. of Zoology. Biorn Ganning

Occologia (Berl), Vol 5, p 127-137, 1970. 5 fig, 16

Descriptors: *Aquatic animals, *Aquatic microbiology, *Acaricides, Brackish water, Microenvironment, Littoral, Oxygen, Chemical reactions, Hydrogen ion concentration, Algae, Reproduction, Sampling, Seasonal, Bottom sediments, Ice, Amphipoda.

Identifier: *Hyadesia fusca, *Sarcoptiformes, *Rockpools, *Enteromorpha, Sweden, Tigriopus brevicornis, Gammarus duebeni, Fucus serratus, Fucus vesiculosus, Cladophora glomerata, Heterocypris salinus, Gasterosteus aculeatus, Baltic Sea, Nitocra spinipes.

The salt water mite Hyadesia fusca has been recorded in Scandinavia for the first time. It is enrecorded in Scandinavia for the first time. It is entirely restricted to the green alga Enteromorpha spp in littoral zones or in rockpools, and is the dominant fauna of many brackish water rockpools. The algae serve as substratum, food and breeding room and give rise to violent fluctuations in abiotic environmental parameters. Oxygen availability and hydrogen-ion activities do not differ greatly inside hydrogen-ion activities do not differ greatly inside and outside the algal thalli. During breeding in June and July more than 900 animals, mostly larvae, may be found on 0.1 gram Enteromorpha dry weight. In winter and average of 13 hibernating animals were found per 0.1 gram algae. Copulation follows after a long precopula; newborn larvae are often found near the rhizomes inside algal tubes. The mite is very tolerant of salinity variations. Hyadesia fusca is characteristic of rockpool Hyadesia lusca is characteristic of lockpoor ecosystems, often very abundant, one of the few Enteromorpha grazers of the ecosystem and serves as food for fishes in the system. Together with some better known crustaceans this mite, because of its tolerance and survival capabilities, must be considered one of the hardient members of the unstable rockpool ecosystems. (Jones-Wisconsin)

MICROFLORA OF CHLORELLA K DURING A PROLONGED CULTIVATION OF THE ALGAE IN A PERFUSION UNIT WITH A CONTINUAL RECYCLING OF THE CULTURE MEDIUM, (IN

Moscow State Univ. (USSR). Faculty of Biology and Soil Science.

and soil science.
M. N. Pimenova, I. V. Maximova, G. I. Meleshko,
E. K. Lebedeva, and T. B. Galkina.
English summary. Mikrobiologiya, Vol 39, No 4, p
645-650, 1970. 1 fig, 3 tab, 17 ref.

Descriptors: *Laboratory tests, *Chlorella, *Cul-*Aquatic microorganisms, Spores, Algae, ogical studies, Mycobacterium, Pseu-Cytological studies, domonas, Bacteria.

Identifiers: Perfusion unit, Flavobacterium, Micrococcus.

The composition and density of microflora accompanying Chlorella K were determined during a prolonged cultivation of the algae in a perfusion unit with a continual recycling of the nutrient medium. The predominant organisms belonged to four genera: Mycobacterium, Flavobacterium, genera: Mycobacterium, Flavobacterium, Micrococcus, and Pseudomonas. The latter were particularly numerous and diversified. The spore-forming cells did not exceed 0.01% of the total number of bacteria. The fluctuation in the density of associated microorganisms and spores were re-lated to performance of algae and the ratio between the photosynthetically active cells, parent cells, and autospores. (Wilde-Wisconsin)

ORGANOCHLORINE INSECTICIDE INTERACTIONS AFFECTING RESIDUE STORAGE IN RAINBOW TROUT,

KAINBOW TROUT, Utah State Univ., Logan. Dept. of Animal Science; and Utah State Univ., Logan. Ecology Center. F. L. Mayer, Jr., J. C. Street, and J. M. Neuhold. Bulletin of Environmental Contamination and Toxicology, Vol 5, No 4, p 300-310, 1970. 4 tab, 22 ref. NWA Grant GM:1179 FWPCA Grant F1-WP-31.

Descriptors: *Chlorinated hydrocarbon insecticides, *Retention, *Rainbow trout, Insecticides, DDT, Dieldrin, Fish, Metabolism, Lipids, Enzymes. Identifiers: *Residual insecticide interactions, *Insecticide interactions, Tissues, DDE, Methoxvehlor.

Most organisms are probably exposed to several insecticides in their environments and many types have been found to contain residues of more than one insecticide. Insecticide interaction effects in rainbow trout simultaneously treated with up to three organochlorine insecticides was studied with relation to residual insecticides accumulated in the visceral fat body. DDT, methoxychlor, and dieldrin

in three levels each were used in a randomized factorial design. Analysis was made for lipid content and residues. The insecticide-containing fraction was analyzed by gas chromatography with electron capture detection. Tissue storage of DDT and DDE increased when DDT and dieldrin were fed in combination. The response was the same as in rats, but was intensified in fish. Dieldrin storage was reduced by the presence of either DDT of methoxychlor. The effect of methoxychlor was more pronounced than that of DDT; feeding DDT with methoxychlor resulted is decreaded. methoxychlor resulted in decreased methoxychlor storage. The influence of dieldrin on increasing tisstorage. The influence of dieldrin on increasing tissue methoxychlor was highly significant. Insecticide interactions in fish and rats differ greatly. DDT, and possibly methoxychlor, could bring about a selective induction of drug metabolizing enzymes in the liver of trout. (Jones-Wisconsin) W71-08030

OXYGEN CONSUMPTION AND THE RESPIRATORY PIGMENT IN THE FRESH-WATER NEMERTEAN, PROSTOMA RUBRUM,

Bridgeport Univ., Conn. Dept. of Biology John J. Poluhowich.

Comparative Biochemistry and Physiology, Vol 36, p 817-821, 1970. 2 fig, 1 tab, 20 ref.

Descriptors: *Aquatic animals, *Oxygen, *Worms, *Respiration, Freshwater animals, Pigments, Freshwater, Weight, Metabolism, Connecticut, Anaero-

bic conditions.
Identifiers: *Nemerteans, *Prostoma rubrum, Hemc-pigment, Hemoglobin, Phylum, Respiratory

Representatives of the Nemertea, acoelomate worms, inhabit marine, freshwater, and terrestrial environments. The oxygen consumption and respiratory rate of Prostoma rubrum were determined at 20C. The mean respiratory rate for 49 specimens was 0.700 microliters of oxygen/mg dry weight per hour. Oxygen consumption varied with the 0x478 power of the body weight. Treatment of the worms with gas mixtures having low oxygen tensions had little effect upon the respiratory rate. However, in similar atmosphere containing carbon monoxide, the oxygen consumptions were mar-kedly reduced. The possibility exists that the respiratory enzymes of this animal are extremely sensitive to carbon monoxide and the decreased oxygen consumption in treated animals may reflect an interference by this gas. Chemical tests confirmed that the red coloration is, at least partially, due to the presence of a heme-containing pigment. Definite rhomboid crystals of the hemochromogen were observed in the Prostoma preparation after the addition of the Takayama reagent. Apparently the blood pigment of Prostoma rubrum allows it to respire at a constant rate under conditions of low oxygen tensions. (Jones-Wisconsin) W71-08031

FOOD NICHE AND CO-EXISTENCE IN LAKE-DWELLING TRICLADS,

North Wales Univ. College, Bangor (United Kingdom). Dept. of Zoology; and University Coll. of North Wales, Bangor. Dept. of Zoology. T. B. Reynoldson, and R. W. Davies.

Journal of Animal Ecology, Vol 39, No 3, p 599-617, 1970, 3 fig, 16 tab, 24 ref.

Descriptors: *Worms, *Diets, *Distribution, Predation, Competition, Gastropods, Oligochaetes, Animal behavior, Aquatic populations, Food abundance, Lakes, Food habits, Laboratory tests. Identifiers: *Coexistence, *Triclads, Britain, Food partitioning, Polycelis nigra, Polycelis tenuis, Interspecific competition, Dugesta polychroa, Dendrococlum lacteum, Asellus, Serological technique, Intraspecific competition.

To explain distribution of four species of triclads living together in shallow littoral zones of British lakes, a hypothesis was developed relating to their distribution and abundance on the basis of interspecific competition for food. Because direct examination of the gut contents was unprofitable, a serological technique made possible the first comparative study of natural food of lake-dwelling triclads. A positive precipitin reaction obtained from a squash of a triclad when tested with the antisera indicates which prey had been consumed; a negative reaction indicates that these prey had not been consumed within the detection period. The triclad populations of 12 lakes, involving tests of 2282 animals were examined. Although the diets overlap, Polycelis tenuis and Polycelis nigra feed to a greater extent on oligochactes, Dugcsia polychroa on gastropods, and Dendrocoelum lacteum on Asellus. The distribution of Dendrocoelum lacteum is significantly associated with Asellus; it is not linked with the distribution of Gammarus another prey consumed less. While there were changes in proportions of the various prey at different seasons, diets were similar within a species and characteristic of that species. (Jones-Wiscon-W71-08033

THE COPEPODA AND CLADOCERA OF A MISSOURI RIVER RESERVOIR: A COM-PARISON OF SAMPLING IN THE RESERVOIR AND THE DISCHARGE, Burcau of Sport Fisheries and Wildlife, Yankton,

S.D.

Limnology and Oceanography, Vol 12, No 1, p 125-136, 1967. 6 fig, 4 tab, 17 ref.

Descriptors: *Measurement, *Plankton, *Automation, Sampling, Reservoirs, Copepods, Crustaceans, Missouri River, Standing crop, Lakes,

Plankton nets, Zooplankton.
Identifiers: *Automatic sampler, Cladocerans,
Gavins Point Dam (\$ D-Neb), Lewis and Clark
Lake, Niobrara River (Neb).

Monitoring of plankton was accomplished by an automatic sampler installed at discharges from Lewis and Clark Lake. The results of sampling coincided with those obtained with tow nets. The annual discharge of Copepoda and Cladocera on wet basis was estimated in the proximity of 13 tons. The discharge was influenced by the inflow of zooplankton from Lake Francis, 80 km upstream, to a greater extent than by the inflow from tributary creeks. (See also W70-05422) (Wilde-Wisconsin) W71-08036

PRODUCTION OF MALE GAMETES AND AUX-OSPORES IN A POLYMORPHIC CLONE OF THE CENTRIC DIATOM CYCLOTELLA, Connecticut Univ., Storrs. Biological Sciences

Mary E. Schultz, and Francis R. Trainor. Canadian Journal of Botany, Vol 48, No 5, p 947-951, 1970. 3 fig, 3 tab, 12 ref. OWRR Project A-014-CONN (2).

Descriptors: *Diatoms, *Cytological studies, Salinity, Plant morphology.
Identifiers: *Cyclotella, Cyclotella eryptica,
Cyclotella meneghiniana, Valve morphology, Aux-

ospore production, Clones, Polymorphism, Toxonomy, Male gametes, Heterotrophs.

Increase in salinity of the medium induced the vegetative cells of Cyclotella clone (03A) to form male gametes and auxospores. During the clonal development of the auxospores, Cyclotella meneghiniana and C cryptica exhibited two valve patterns. Environmentally controlled valve morphology is distinguishable, the male gamete of the polymorphic clone being anteriously uniflagel-late. (Wilde-Wisconsin) W71-08037

STUDIES ON THE POST-MORTEN IDENTIFI-CATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION--XII. ACUTE

Group 5C—Effects of Pollution

POISONING WITH MERCURY (1), (IN

Tohoku Univ. Sendai (Japan). Dept. of Fisheries; and Miyagi Technical Coll. (Japan). Dept. of Metal

Yoshiko Haga, Hideo Haga, Tokiko Hagino, and Teiji Kariya.

English summary. Bulletin of the Japanese Society of Scientific Fisheries, Vol 36, No 3, p 225-231, 1970. I fig, 7 tab, 8 ref.

Descriptors: *Fish, *Water pollution effects, *Toxins, Aquatic animals, Aquatic environment, Chemical wastes, Inorganic compounds, Pollutant identification.

limit, Gill, Kidney, Spleen, Abukuma River (Japan), Hirose-Natori River (Japan), Zacco platypus.

An attempt was made to detect mercury in fish killed by mercuric chloride in solution. The 48hour median tolerance limit of mercuric chloride for goldfish lay between 1 and 0.5 ppm mercury and 5 ppm mercury was fatal in about 10 hours. Mercury content of control fish (fish killed by various concentrations) and of those living in 0.5 ppm mercury solution for 48 hours is given. Goldfish died in 0.5 ppm mercury solution within 6 or 7 days. Amount detected in dead fish is given. The distribution of mercury in seven parts of fish body was examined in two cases; the first being killed by mercury in solution and the second after soaking in mercury solution following death from suffocation. The first showed the highest value in the gills with that in the kidney next. In the second, mercury content showed low values in every part examined and scarcely detectable in spleen and kidney. Tests on some aquatic animals were performed to determine the possibility of mercury distribution in the Abu-kuma and Hirose-Natori Rivers with results indicating no mercury pollution. (Jones-Wisconsin) W71-08038

DETERMINATION OF THE ACTIVITY OF HETEROTROPHIC MICROFLORA IN THE OCEAN USING C-14-CONTAINING ORGANIC MATTER,

Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.

Yu. I. Sorokin.

Trans from MIKROBIOLOGIYA, Vol 3, No 1, Jan-Feb 1970. Microbiology (USSR) Vol 39, No 1, p 133-138, 1970. 5 fig. 4 tab, 22 ref.

Descriptors: *Oceans, *Organic matter, *Carbon radioisotopes, *Analytical techniques, *Marine microorganisms, Marine plants, Bacteria, Population, Hawaii, Absorption, Tropical regions, Pacific Ocean, Columns, Bottom sediments, Algae, Chlorella, Benthic flora, Mud, Microorganisms, Proteins, Radioactivity techniques, Food chains. Identifiers: *Algal hydrolysate, Tonga Islands, Tu-tuila Island, Honshu Island, Open ocean, Saprophytes, Heterotrophic bacteria, C-14.

The possibility of using carbon-labeled dissolved organic matter (algal hydrolysate) for estimating the comparative activity of natural populations of microflora in the water column and bottom deposits was investigated in the tropical zone of the Pacific Ocean. The criterion for microfloral activity was the rate of bacterial assimilation of carbon-14 in experiments of short duration. The rate and utilization efficiency of labeled organic matter by sea water microflora depend on its initial concentration. The maximum utilization efficiency of dissolved organic matter by aquatic microflora for biosynthesis was 45%, staying quite high even when the initial concentration of labeled hydrolysate added was 1 to 2 mg/l. Supported is the idea that bacterial destruction of organic material in the ocean is limited to the upper water layer to a depth of 600 to 800 meters, with the maximum in the tropical zone at depths of 400-600. At great ocean depths the heterotrophic microflora is scant and slightly active. Information about the efficiency of utilization of dissolved organic matter by the

aquatic microflora is of paramount importance for estimating its role as a link in the food chain.
(Jones-Wisconsin) W71-08042

SATELLITE FUNGI OF MANGANESE-OXIDIZ-

ING BACTERIA, Moscow State Univ. (USSR). Dept. of Soil Biology. T. G. Mirchink, K. M. Zaprometova, and D. G. Zvyagintsev.

Trans from MIKROBIOLOGIYA Vol 39, No 2, Mar-Apr 1970. Microbiology (USSR) Vol 39, No 2, p 327-330, Mar-Apr 1970. 3 fig, 2 tab, 15 ref.

Descriptors: *Fungi, *Manganese, Microorganisms, Podzols, Soils, Oxidation. Identifiers: *Satellite fungi, Manganese-oxidizing bacteria, Metallogenium, Moscow (USSR), Nov-gorod (USSR), Estonia (USSR), Coniothyrium fuckelii, Mycogone nigra, Fusarium Kuhni, Alter-

naria geophila, Cephalosporium, Sterile mycelium, Manganese-oxidizing, Soil agar.

This investigation was made to determine species of fungi which exist in soil together with Metallogenium, how great their diversity, and how often found in soddy podzolic soil. Twenty-one strains of fungi growing together with microorganisms of the genus Metallogenium were isolated from soddy podzolic soils of the Moscow and Novgorod regions and Estonian SSR with the use of soil agar. The isolated satellite fungi of Metallogenium are represented by the species: Coniothyrium fuckelii Sac, Mycogone nigra (Morgan) Jensen, Fusarium Kuhni (Fuck) Sac, Alternaria geophila Dasz, Cephalosporium, and forms of sterile mycelium. The colonies of microorganisms were located either directly on the hyphae or at some distance from the mycelium. Cultures of fungi growing together with Metallogenium were regularly isolated from all soils used. On the media used many isolated cultures formed fruit-bodies, on the basis of which most of them were identified. The development of Metallogenium was greatly inhibited on these media with the use of streptomycin. The data obtained indicate that not one specific species of fungus but various species, represented mainly by known forms but which have acquired a unique structure due to coexistence with Metallogenium, can be satellite fungi of Metallogenium. (Jones-Wisconsin) W71-08043

THE EFFECTS OF RETURN IRRIGATION WATER ON THE BASAL LENS IN KAHUKU PLANTATION, OAHU AND PIONEER MILL AND HAWAIIAN COMMERCIAL AND SUGAR COMPANY PLANTATIONS ON MAUI,

Hawaii Univ., Honolulu.

Pedro A. Tenorio.

M. S. Thesis, Hawaii University, Aug 1970. 176 p, 66 fig, 7 tab, 54 ref, append. Project B-012-HI (2).

Descriptors: *Water pollution sources, *Water pollution effects, *Return flow, *Saline water intrusion, *Hawaii, Irrigation water, Water chemistry, Solutes, Nitrates, Salinity, Withdrawal, Groundwater, Groundwater movement, Leaching, Infiltration, Water quality.

Identifiers: Oahu (Hawaii), Maui (Hawaii).

The effects of irrigation return water on the quality of the basal groundwater bodies were identified and described in 3 areas on the islands of Oahu and Maui. Presently, all three areas are planted with sugarcane. Leaching of fertilizer components, principally nitrate and sulfate, into the basal aquifer occurs as a result of irrigation water application over the fields. Excessive withdrawals of the basal water in simple Ghyben-Herzberg lens accelerates saline water intrusion. All of the irrigation water sources from the three areas are suitable for the irrigation of sugarcane crop. (Knapp-USGS) W71-08044

POLLUTION EFFECTS ON MICRO- AND

MEIOFAUNA OF SAND, Leeds Univ. (England). Wellcome Marine Lab. John S. Gray, and Ronald J. Ventilla. Marine Pollution Bulletin, Vol 2, No 3, p 39-43, Mar 1971. 5 p, 10 fig, 2 tab, 8 ref.

Descriptors: *Water pollution effects, *Marine plants, *Oceans, *Coasts, *Sands, Sediments, Municipal wastes, Industrial wastes, Sewage, Aquatic plants, Growth rates, Growth stages.
Identifiers: *Microfauna, *Meiofauna.

The growth rates of a bacterivorous sediment-living ciliate (Cristigera) was significantly slower in the presence of low concentrations of heavy metals. The metals acted synergistically on the growth rate. The technique is sensitive and rapid and could be used as a reliable bioassay for assessing suspected polluted scawater. Temporal studies comparing a suspected polluted and unpolluted beach showed that they had significantly different numbers of meiofauna. Such differences could not, however, categorically be related to pollution. A spatial study at one beach showed a significant change in numbers of meiofauna where sewage pollution occurred. The spatial approach in indicating objectively polluted areas for further study, should be considered before long-term studies of temporal effects of pollution are attempted. (Woodard-USGS) W71-08082

PRINCIPAL ELECTRICAL MECHANICAL PROPERTIES OF AEROSOLS. APPLICATION TO HEALTH PHYSICS (IN

Commissariat a l'Energie Atomique, Saclay (France). Service de Protection Contre les Radia-

Claude Lasseur.

Bibliographie CEA-BIB-185, Service Central de Documentation du CEA, Gif-sur-Yvette, Oct 1970. 56 p, 11 tab, 7 fig, 69 ref.

Descriptors: *Acrosols, *Electrical properties, *Mechanical properties, *Public health, Stokes law, Water pollution effects.

Identifiers: Ion mobility, Particle charge, Polarization, Respiratory system.

The mechanical and electrical properties of acrosols are analyzed. Stokes law and the limits to its application, diffusion, and coagulation are considered. The polarization phenomena is briefly mentioned. Examples of the applications, in health physics, of the different aerosol properties and of the results obtained in the study of a model respiratory system are given. Methods and apparatus used in the study are described. (Ensign-PAI) W71-08154

COASTS OF FRANCE, GENERAL STUDY OF CHEMICAL POLLUTION DISCHARGED INTO THE SEA. INVENTORY AND STUDY OF TOXICITY, VOLUME III, ATLANTIC (IN FRENCH), Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).

M. Aubert, J. Aubert, J. P. Gambarotta, B. Donnier, and M. Barelli.

Revue Internationale d'Oceanographie Medicale, Supplement, Tome III, 1970, 225 p.

Descriptors: *Water pollution sources, *Pollutants, *Chemical wastes, *Atlantic Ocean, Water pollution effects. Estuaries. Identifiers: French coastal areas.

There is no text. Tables, charts and graphs of this supplement show the toxicity of industrial waste water in the French littoral of the Atlantic. Data reported include chemical, physical and biological aspects of river discharge in the coastal estuaries. (See also W71-07189 and W71-07190) (Ensign-PAI W71-08165

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

ENVIRONMENTAL FACTORS AFFECTING BAY AND ESTUARINE ECOSYSTEMS OF THE TEXAS COAST,

Coastal Ecosystems Management, Inc., Fort

Robert H. Parker, and William George Blanton.

Available from the National Technical Information

Available from the National Technical Information Service as PB-197 042, \$3.00 in paper copy, \$0.95 in microfiche. Coastal Ecosystems Management Report 70-01, Nov 1970. 182 p.

Descriptors: *Environmental effects, *Estuaries environment, *Estuaries, *Water pollution effects, Salinity, Ecology, Ion transport, Brine disposal, Silts, Coasts, Bays, Temperature, Aquatic life, Oil industry.

Identifiers: Coastal topographic features, Oil base muds, Ion density concentration.

Over 200,000 data points relating to range of environmental factors in all major Texas estuaries from Louisiana to Mexico were utilized to establish variability of total salinity and constituent ions in these estuaries. This was done to determine possible effects of oil field brines upon Texas coastal ecosystems. Diversity and faunal abundance were compared with environmental variability. Baseline values for benthic and nektonic populations were established for both undisturbed and industrially disturbed estuaries. In all bays, salinity and temperature variations were very pronounced, geographically and temporally. Range of variation and mean winter and summer salinities could be directly correlated with sizes and diversity of animal populations and with major changes from year to year to seafoods. Data from 572 stations relating to ionic constituents of Texas bay waters were statistically evaluated for their variability and translated into 'ionic balance' format. Extreme variability from time to time, and place to place demonstrated that this concept of 'ionic balance' is invalid in estuaries systems. W71-08181

THE EFFECTS OF SALINITY STANDARDS ON IRRIGATED AGRICULTURE IN THE COLORADO RIVER BASIN,

Federal Water Pollution Control Administration, Boulder. Colorado River - Bonneville Basins Of-

For primary bibliographic entry see Field 05G. W71-08222

ELECTRIC POWER AND THERMAL DISCHARGES; THERMAL CONSIDERATIONS IN THE PRODUCTION OF ELECTRIC POWER. For primary bibliographic entry see Field 05B. W71-08298

SPECTRUM OF BIOLOGICAL CONCERNS FROM POWER PLANT THERMAL DISCHARGES,

Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering. Loren D. Jensen.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power, Gordon and Breach, New York, p. 47-73, 1971, 5 fig., 10 ref.

Descriptors: *Thermal powerplants, *Biota, Behavior, *Thermal stress, Speciation, *Acclimatization, *Reproduction, *Physiological ecology, *Growth rates, Growth stages, Benefits, [her-

mal pollution. Identifiers: *Thermal tolerance, *Biocides, Heat synergism, Temperature response, Extremal temperatures.

The biological rationale for water quality criteria to minimize the environmental effects of power generation while at the same time maximizing the benefits of economical power generation for mankind will require the early involvement of ecologists, engineers and other specialists in the siting, design and operation of steam electric generating stations. The author discusses thermal tolerance of aquatic organisms in different life stages, reaction of individual species to heat, speciation resulting from thermal stress, heat synergism and order of duration of temperature response. Fluctuations in temperature have been shown to have as great an effect on organisms as extremal temperatures, the effect being most stressing when the amplitude of change and its rate are greatest. Some beneficial effects of increased temperatures are pointed out. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08302

IMPACTS OF THERMAL ALTERATIONS ON ESTUARINE AND COASTAL ENVIRONMENTS, Virginia Inst. of Mari ne Science, Gloucester Point.

Virginia Inst. of Mari ne Science, Gloucester Point, W. J. Hargis, and J. E. Warinner. In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York p 75-141, 1971. 11 fig, 2 tab, 45 ref.

Descriptors: *Estuarine environment, *Thermal powerplants, *Heated water, *Environmental effects, Design criteria, Water quality control, Sites, Biota, Thermal stress.

Identifiers: *Coastal environment, Heat utilization, Thermal tolerance, Biocides, Temperature response, Aquatic life.

On the basis of extensive literature study the authors arrive at the conclusion that releases of heat into tidal and marine environment must be carefully tailored and managed. Every effort should be bent toward developing methods to use the heated effluents in productive ways. These activities should, among the others, entail (1) development of adequate institutional mechanisms, (2) development of mathematical and hydraulic models for every major marine or coastal system, (3) more adequate siting criteria and water quality criteria and standards, (4) development of more flexibility in regional and interregional generating systems, (5) development of more adequate of fluent pre-cooling systems and techniques to use the heat productively, (6) more efficient means of reducing environmental heat loading. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08303

CONFERENCE ON IMPACT OF FUTURE ELECTRIC POWER REQUIREMENTS IN THE STATE OF MINNESOTA - AN ISSUE ANALYSIS.

Minnosota Univ., Minneapolis. Water Resources Research Center.

Available from the National Technical Information Service as PB-199 542, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Research Center, Minnesota University, Graduate School, WRRC Bulletin 28, p 38, Feb 1971. OWRR Project A-999-

Descriptors: *Electric power demand, *Electric power production, *Thermal powerplants, *Environmental effects, *Thermal pollution, Air pollution, Solid wastes, Economic impact, Radiation, Fransmission lines, *Minnesota.

The objectives of the conference were to discuss future electric energy needs in the state of Minesota and alternative means for meeting these requirements. Issues identified were associated with: impact of power plant and transmission line proliferation on the natural environment, on the economics, on the life of the people, on the politico-legal situation in the affected areas and on the state if power plants and transmission lines are not built. Potential thermal water pollution was discussed, together with potential air pollution, solid wastes disposal problems, radiation hazards, land management schemes, and potential depletion of natural resources. The emphasis was on examination of all possible issues and not on problem solution, (Oles/kiewicz-Vanderbilt)

BACKGROUND STUDY FOR POND COOLING FOR INDUSTRY,

Oregon State Univ., Corvallis. Fred W. Decker.

AEC AT (45-1). Mar 31, 1970. RLO-2218-1, 53 p.

Descriptors: *Thermal powerplants, *Nuclear powerplants, *Heated water, *Cooling towers, Rivers, Lakes, Fog, Biota, Thermal pollution. Identifiers: *Cooling ponds.

The use of lakes and slack water for the disposition of waste heat from thermal power plants was studied based on European experience. Scientists appear preoccupied with the establishment of limits to the allowable discharge of heat into streams. In Switzerland and Bavaria work continues on the prescription of the limits as to how much and in what manner heat may discharge into streams. In the Netherlands already the forecast emerges of eventually more heat than the Rhine and impounded waters can handle. In France studies seek to specify limits for discharge of heat into the inland slack waters of major controlled rivers. In Britain the studies of a lake used for cooling a nuclear power plant will reveal objective data on the modifications in the lake conditions, but new construction generally assumes the use of cooling towers because of the general shortage of water available for cooling. It appears that cooling towers have superseded other methods for heat discharge and that increasingly many new major industrial units can no longer seriously consider rivers and lakes for their heat sinks, at least from a standpoint of economic advantage to themselves. (Oleszkiewicy-Vanderbilt) W71-08318

A COMPREHENSIVE APPRAISAL OF THE EF-FECTS OF COOLING WATER DISCHARGE ON AQUATIC ECOSYSTEMS.

Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.

Arthur A. Levin, Birch J. Thomas, Robert E. Hillman, and Gilbert E. Raines. Columbus, Ohio, 1970, 45 p, 9 fig. 2 tab, 137 ref.

Descriptors: *Thermal pollution, *Heated water, *Cooling water, *Aquatic environment, *Dissolved oxygen, Water temperature, Fishkill, Environmental effects, Parositism, Aquatic populations.

Identifiers: *Aquatic ecosystems, Thermal tolerances.

A discussion of the effects of cooling water discharge on receiving waters is given in the present report. It is stated that one of the most important effects on the aquatic ecosystem is the response of the aquatic biota either as a direct result of an increase in water temperature or as a subsequent result of physical-chemical changes of the water due to an increase in water temperature, such as: density, viscosity, vapor pressure, surface tension, solubility of dissolved gases in water, etc. can cause stratification of bodies of water, increase in evaporation and rate of biochemical reactions. Elevated temperatures increase the metabolic rate of most organisms until the upper lethal limit is reached. Analysis of the ability of water to hold adequate concentrations of dissolved oxygen to support aquatic organisms are also given. It is concluded that whether actively managed for the benefit of man or passively observed for their impact, thermal additions will cause environmental changes. With most of the actual operating plants, the changes due to thermal additions have not proved to be harmful. No major fishkills due to thermal effluents have been observed of operating power plants. (Herrera-Vanderbilt) W71-08319

Group 5D—Waste Treatment Processes

5D. Waste Treatment Processes

COST AND MANPOWER FOR MUNICIPAL WASTE WATER TREATMENT PLANT OPERA-TION AND MAINTENANCE,

Federal Water Quality Administration, Washington, D.C. Construction Grants and Engineering

Journal Water Pollution Control Federation, Vol 42, p 1883-1915, Nov 1970. 20 fig, 31 tab, 9 ref.

Descriptors: *Costs, *Waste water treatment, *Operation and maintenance, Correlation analysis,

Trickling filters, Lagoons. Identifiers: *Total population equivalent, *Industrial population equivalent, Total weekly manhours, Sludge process, Power consumption.

An analysis was made of the operation and main-An analysis was made of the operation and mani-tenance expenditure and manpower requirements for waste water treatment works as reported for some 1,600 such audits during the period January 1965 to June 1968. A statistical test (simple linear correlation) was used to determine the trends between the following combinations of variables: (1) Total annual cost vs. average flow rate; (2) Total annual cost vs. population equivalent load;
(3) Annual labor cost vs. average flow rate; (4) Annual labor cost vs. population equivalent load; (5) Annual electricity cost vs. average flow rate; (6)
Annual electricity cost vs. population equivalent
load; (7) Annual chemical cost vs. average flow
rate; (8) Ahhual chemical cost vs. population equivalent load; (9) Total weekly man-hours vs. average flow rate; (10) Total weekly man-hours vs. population equivalent load. All the results were plotted on figures. In general, the cost patterns derived from this study were very similar to those derived from the 1,500 reports of a different set of plants audited between 1962 and 1965. (Wang-Rutgers) W71-07743

ECONOMIC EVALUATION: ALTERNATIVES FOR INDUSTRIAL TREATMENT,

Wichita State Univ., Kans.

K. Q. Camin.

Water and Sewage Works, Vol 116, No 7, p IW/10 - IW/13, July 1969, 4 tab, 1 fig.

Descriptors: *Evaluation, *Costs, Biochemical oxygen demand, Discount rate, Trickling filters, Operation and maintenance, Cost comparisons. Identifiers: *Alternatives, *Industrial waste treatment, Municipal waste treatment, Waste water strength

With reduction of pollution content as their goal, industries whose manufacturing processes generate substantial wasteloads usually have several alternative solutions. This paper discussed what waste treatment alternative would give a specified amount of waste reduction at minimum cost. To illustrate the theory and method of evaluation, emphasis was placed upon 'municipal waste treatment' and 'industrial waste treatment.' It indicated that a change in wasteload (lb of BOD) per unit of product varied directly with waste water volume per unit of product. Cost for municipal treatment and industrial treatment were discussed respectively. For meaningful comparison all cost streams were converted into present value. It was noted that the optimal choice would change if the discount rate or the time horizon were different. (Wang-Rutgers) W71-07752

CHEMICAL TREATMENT OF COMBINED SEWER OVERFLOWS.

Dow Chemical Co., Midland, Mich.

available from GPO, Sup Doc EP2.10:11023FDB \$1.50; microfiche from NTIS as PB-199 070, \$0.95. EPA Report 11023 FDB-09/70, Sept 1970. 185 p, 56 fig, 50 tab, 54 ref. EPA-WQO Contract No 14-12-9. Descriptors: *Water pollution control, *Flocculation, Sedimentation, Storms, Runoff, Flow rates, Biochemical oxygen demand, Coliforms, Pumps, Chlorination, Disinfection, Baffles, Weirs, Waste water treatment, *Sewers, *Overflow.

Identifiers: *Combined sewers, Purifloc C31, Pu-

Less than 8% of the total sanitary sewage flow collected in the Milk River combined sewer has been by-passed during periods of storm overflow during the past 8 years. Total overflow volumes did not ex-ceed 5.5 million cubic ft. 90% of the time. Initial ceed 5.5 million cubic ft. 90% of the time. Initial BOD over 18 samples ranged from 23 mg/l to 376 mg/l with an average of 110 mg/l, while suspended solids averaged 249 mg/l. On final samples taken during the same period, BOD values averaged 42 mg/l and SS values averaged 67 mg/l. Chlorine demand for 56 influent samples averaged 7.7 mg/l. The receiving waters for these overflows were characterized by visual observation as being highly polluted. Cationic polymeric flocculants and floculent aids were tested on combined overflows culent aids were tested on combined overflows from the sewer system. It was found that the existing Milk River pumping station and retention basin were suitable for modification, namely the addition of weirs and variable rate pumping, to achieve an average SS removal of 63%. The installation of disinfection equipment was estimated to cost \$20,625 with \$7,700 annually for chemical costs. This equipment would produce a coliform density of 1000/100 ml at an average cost of approximately \$0.012/1000 gallons. (Lowry-Texas) W71-07755

RENOVATION OF MUNICIPAL WASTE WATER BY REVERSE OSMOSIS,

Environmental Protection Agency, Cincinnatti, Ohio. Environmental Research Lab. John M. Smith, Arthur N. Masse, and Robert P.

Copy available from GPO, Sup Doc as EP2.10:17040-05/70, \$0.65; microfiche from NTIS as PB-199 067, \$0.95. EPA Report 17040--05/70, May 1970. 59 p, 23 fig, 17 tab, 12 ref.

Descriptors: *Reverse osmosis, *Municipal wastes, Separation techniques, Desalination processes, Demineralization, Semi-permeable membranes, *Water re-use, Pressure, Hydrogen ion concentration, Filtration, Adsorption, Sedimentation, Pilot plants, Cost analysis, *Waste water treatment, Osmosis, *Membranes.

Identifiers: Flux, Rejection, Membrane fouling.

The three major configurations of reverse osmosis units include spiral wound units, tubular units, and plate and frame units. Tests were conducted on prototype units employing all three configurations, and the membranes were found capable of rejecting 93 to 95% of TDS, 90 to 99% of phosphates, 80 to 90% of ammonia nitrogen, 60 to 70% of nitrate nitrogen, 99 to 100% of particulate matter, 90 to 95% of TOC and greater than 90% of COD. Many of the problems discovered stemmed from the use of prototype units which had not been throughly tested and were subject to repeated mechanical failures. Fouling problems have been partially alleviated by periodically depressurizing the mem-branes and washing them with enzyme detergents. The success of this method is attributed to protein hydrolysis of the slime layer which coats the membrane. Increasing population has dictated the recycling of a much larger portion of the nation's water. Each time it is re-used, the water picks up greater amounts of dissolved solids. These solids will eventually have to be removed to preserve the potability of drinking water. At present, reverse osmosis techniques are the most promising methods for dissolved solids removals. Also, increasing advances in membrane materials have steadily decreased the cost of reverse osmosis to the point that a reverse osmosis system coupled with primary and sand filtration only has an estimated cost of 35.4 cents/1000 gallons. This figure is equal to the cost of conventional activated sludge treatment plus filtration and carbon adsorption. (Lowry-Texas) W71-07756

CANNERY WASTE TREATMENT - KEHR ACTIVATED SLUDGE,

FMC Corp., Santa Clara, Calif. Environmental Engineering Dept. Robert A. Fisher.

Copy available from GPO, Sup Doc as EP2.10:12060EZP--09/70, \$0.70; microfiche from NTIS as PB-199 071, \$0.95. EPA Report 12060EZP--09/70.67 p, 20 fig, 15 tab, 7 ref.

Descriptors: *Activated sludge, *Cannery wastes, Industrial wastes, Municipal wastes, Biochemical oxygen demand, Nutrients, Aeration, Mixing, Sedimentation, Pilot plants, Design parameters, Cost analysis, *Waste water treatment. Identifiers: *Kehr activated sludge, Total organic serbon, Electrofication, BOOS

carbon, Electroflotation, BOD5.

The Kehr modification of the activated sludge process uses a completely mixed aeration tank with no intentional solids wasting. After the aeration tank stabilized at between 4000 and 12,000 mg/l of MLSS, a 40 day investigation using municipal and cannery wastes of strengths from 200 to 2000 mg/l BOD5 was conducted. 90% BOD5 and 80% TOC reductions were achieved, but little or no reduction was detected in nitrates and phosphates and the effluent was colored and turbid. Periods of little or no loading for as long as 48 hours caused no decrease in treatment efficiency when flow was resumed. From the above information, KASP was recognized as being well suited to industrial waste pre-treat-ment prior to discharge to a municipal treatment plant. The ability to handle intermittent flows provide 90% BOD5 removal, and provide aerobic digestion of solids in the aeration tank is essential Gestion of soiles in the aeration tank is essential for pre-treatment devices and all are possessed by KASP. Exclusive of primary treatment, treatment of 10 mgd of a 250 mg/l BOD5 waste would cost 7 cents/1000 gallons using gravity settling. Because of operational problems and high power demand, the use of the electroflotation instead of gravity settling would increase costs to 29 cents/1000 gallons to the electroflotation instead of gravity settling would increase costs to 29 cents/1000 gallons treated. In each instance, however, the variability of industrial wastes demands pilot plant studies to determine actual design criteria and cost estimates. (Lowry-Texas) W71-07757

TREATMENT OF SOLE LEATHER VEGETA-BLE TANNERY WASTES,

Cincinnatti Univ., Ohio. Environmental Health En-

J. David Eye

Copy available from GPO, Sup Doc as 167 13/4:12120, \$1.25; microfiche from NTIS as PB-199 068, \$0.95. EPA Report 12120--09/70, Sept 1970. 112 p, 21 fig, 25 tab, 23 ref.

Descriptors: *Industrial wastes, *Lagoons, Anaerobic conditions, Aerobic conditions, Pilot plants, Design criteria, Pre-treatment (Water), Sedimentation, Screens, Temperature, Color, Odor, Turbity, Lime, Cost analysis, *Waste water treatment, West

Identifiers: *Tanneries, Marlinton.

A three year study was conducted to determine the feasibility of treating tannery wastes biologically. A pilot plant was operated first to determine the design parameters, after which a full scale system was constructed. The full scale system consisted of specialized pre-treatment of segregated waste streams, primary clarification, and an anaerobicaerobic lagoon system. 10 mg/l of anionic polyelectrolyte was added to the primary clarifier to enhance settling. At clarifier overflow rates ranging from 1600 to 2500 gpd/sq ft, 80 to 90% removal of suspended lime particles was obtained. Loading on the lagoons ranged from 2-20 lbs BOD/day/1000 cu ft with removals ranging from 80 to 95% except during cold weather, when removals in the 65-75% range were observed. Odors emanating from the lagoons were effectively controlled through the ad-dition of spent vegetable tan liquors. Foaming problems were solved through use of high pressure nozzles. However, these nozzles could not be used when the temperature was below freezing. The main concern of tanneries should be directed

Waste Treatment Processes—Group 5D

towards waste flow minimization and pretreatment. 70% of the pollutional load is present in 30% of the waste volume. Education of operating personnel is of prime importance in reducing flows to reduce of prime importance in reducing flows to reduce costs. The total cost of the systems as installed at Marlinton was \$40,000, with operating costs averaging \$15,000/year or \$.07/hide processed with a flow of 1 million gallons/week. Further, work is necessary in color removal and disinfection. Studies on combined treatment of municipal and tannery wastes are also needed since both the tannery and municipality could conceivably benefit from such an arrangement. (Lowry-Texas)

PHENOLIC WASTE RE-USE BY DIATOMITE FILTRATION, Johns-Manville Products Corp., Manville, N.J.

E. I. Merrill.

Copy available from GPO, Sup Doc as 167.13/4:12080EZF, \$1.25; microfiche from NTIS as PB-199 069, \$0.95. EPA Report 12080 EZF-09/70, Sept 1970. 125 p, 25 fig, 17 tab. FWQA Grant WPRD 87-01-68.

Descriptors: *Phenols, Resin, *Water re-use, Design criteria, Chemical precipitation, Screens, *Filtration, Diatomaceous earth, Mixing, Dewatering, Hydrogen ion concentration, Cost analysis, Industrial wastes, *Waste water treatment, New Jer-

Identifiers: Fiberglass, Suspended solids.

Fiberglass production involves the use of an expensive phenolic resin. A 28 month study was conducted to determine the feasibility of reclaming waters which had been used for washing resins off of conveyor lines to prevent fouling. The system developed reduces water consumption by utilizing an 8 gpm, 1000 psi spray cleaner. After the conveyors are washed, the water flows through two stages of screening, or primary filtration, and a secondary diatomite filtration unit. Since most of the solids are large, the diatomite filters accomplish the removal of only .6% of the total solids load, with the major removals taking place at the prescreening equipment. The water re-use system will use the same water 4.5 times before it is completely evaporated, requiring 1 lb of diatomite/500 gallons of water filtered. The system provides water at a net cost of \$.37/1000 gallons as compared to \$.75/1000 gallons for city water. Substantial operational savings have been realized through conservation of the expensive phenolic binder. A net 'before tax' income return of 9.5% has been obtained on the approximately \$165,000 invested. In addition, waste phenolic discharges have dropped 80%, suspended solids have decreased 83%, and dissolved solids have decreased by 50%. In this instance, therefore, waste discharge control has both protected the environment and profited the industry. (Lowry-Texas) W71-07759

Treatment techniques for removing phosphorous

from municipal waste waters, Environmental Protection Agency, Cincinnatti, Ohio. Environmental Research Lab.

John J. Convery.

Copy available from GPO, Sup Doc as EP2.10:17010--01-70, \$0.50; microfiche from NTIS as PB-199 072, \$0.95. EPA Report 17010-01-70, Jan 1970. 35 p, 13 fig, 17 tab, 25 ref.

Descriptors: *Phosphates, Filtration, *Chemical precipitation, Coagulation, Sedimentation, Lime, Alkalinity, Hydrogen ion concentration, Neutralization, Turbidity, Flexibility, Tertiary treatment, *Cost analysis, Economic feasibility, *Waste water treatment.

Biological uptake, chemical precipitation of soluble phosphorus, and settling or filtration of particulate phosphorus are the major removal mechanisms used in phosphorus removal. At present, chemical precipitation is the most universally applied method. The wide variety of chemical reaction

which lead to phosphorus precipitation allows much flexibility of operation to plant operators. In dealing with raw sewage, primary effluent, or secondary effluent the size of the plant, influent waste water characteristics phosphorus discharge standard, and the types of other processes used in the treatment train must all be considered. In addition to phosphorus removal, higher levels of BOD and suspended solids removals are customarily oband suspended solids temovals are customary obtained when some type of phosphate reduction mechanism is employed. Each of the mechanisms described here have been analyzed both with respect to technological and economic feasibility. Costs ranged from 13 cents/1000 gallons for twostage lime treatment of 1 mgd to achieve 97% removal, to a potential low of \$.015/1000 gallons using waste pickle liquor to achieve a reduction of 80%. (Lowry-Texas)

THE THERMAL STABILITY OF NITRILOTRIACETIC ACID AND ITS SALTS IN AQUEOUS SOLUTIONS, Naval Research Lab., Washington, D.C. David L. Venezky, and William B. Moniz. Available from the National Technical Information

Service as AD-715 776, \$3.00 in paper copy, \$0.95 in microfiche. NRL Report 7192, Nov 17, 1970. 11 p, 6 fig, 6 ref. NRL Problems CO5-29 and CO7-04 Project No RR007-02-41-5678 and RR001-05-42-4806.

Descriptors: *Temperature, *Stability, Chelation, Sludge, Hydrogen ion concentration, Waste water treatment, *Chemical precipitation.

Identifiers: *Thermal decomposition, Complexing, Nuclear magnetic resonance, Proton magnetic resonance, Nitrilotriacetic acid, *NTA.

H4EDTA and its salts may decompose thermally through a hydrogen three-centered bridge struc-ture intermediate. By comparison, the thermal decomposition of H3NTA and its salts was studied using nuclear magnetic resonance techniques, since NTA is similar to EDTA, except that it cannot form the bridge structured intermediate mentioned previously. NMR studies at 200C for periods ranging from 1 hour to 670 hours were conducted on degassed and undegassed aqueous solutions of Na3NTA, Na2HNTA, and a degassed solution of H3NTA. Periodic proton magnetic resonance examination showed dissolved oxygen to have little or no effect on Na3NTA and Na2HNTA solution decomposition. Testing results showed NTA3- to be far more stable than EDTA4- at 200C. Extension of this data to the 300C to 320C range is not possible without additional testing. However, at 200C in basic solutions uncomplexed and weakly complexed NTA3- is stable enough to use as a boiler-water additive for sludge control and feedwater conditioning. Such use should produce minimal water contamination from thermally decomposed NTA3-, which could occur only after prolonged heating. (Lowry-Texas) W71-07761

MAGNETIC FLOCCULATION METALLIC SOLIDS. REMOVES

Ericz Magnetics, Eric, Pa.

Water and Sewage Works, Vol 118, No 3, p IW/12-IW/13, Mar 1970.

Descriptors: *Waste water treatment, *Separation techniques, *Flocculation, Coagulation, Sedimentation, Settling velocity, Metals, Industrial wastes, Flow rate, Pennsylvania.

Identifiers: *Magnetic flocculation, Metallic wastes

Metallic contaminants in waste water from steel plants have long required large settling basins with long detention times. Various chemical coagulation and flocculation agents have been tried with limited success, usually accountable to prohibitive cost. The development of a magnetic process, however, has doubled the settling rate of the floc with a

50% decrease in the amount of flocculants required. Also, magnetic solids entrap non-magnetic solids while they are settling to provide a sweeping effect. This phenomenon has stimulated interest in the addition of Basic Oxygen Furnace Dust to waste waters which do not contain any metallic particles. This BOF dust, when magnetized acts as a coagulant aid. Several combined chemical-magnetic flocculation units are already in use. A unit designed for Allegheny Ludium Steel Corporation treats approximately 3500 gpm by subjecting the waste water to a minimum field intensity of 800 gauss for 1/20 seconds. This water originates from the BOF units, but it can also be mixed with waters from the cupola scrubbers. The system then depends upon the magnetized flocs to clear the water of non-magnetized solids as well. At present, no reliable cost analysis has been performed, but research into magnetic treatment is continuing. (Lowry-Texas) W71-07762

A PERFORMANCE ANALYSIS OF AN ACTIVATED SLUDGE TREATMENT PLANT, Toronto Univ. (Ontario). Dept. of Civil Engineer-

ing.
D. F. Carr, and J. Ganczarczyk.

University of Toronto, Department of Civil Engineering, Publication No. 71-600, Feb 1971. 17 p, 10 fig, 7 tab, 4 ref. NRC Grant No A7598.

Descriptors: *Activated sludge, Evaluation, Performance, Statistical methods, Analytical techniques, Sampling, Flow measurements, Biochemical oxygen demand, Dissolved oxygen, *Waste water treatment, *Sludge treatment, *Waste water trea *Treatment facilities.

Identifiers: Sludge loading factor, Sludge volume index, Mixed liquor suspended solids, Toronto,

The difficulty in accurately modeling or scaling various parameters in laboratory scale studies of the activated sludge process has led to attempts to obtain design data from full scale operating plants. It was determined that for this particular test, conducted at the Lakeview Sewage Treatment Plant near Toronto, the flow measurements and sampling procedures applied, as well as the scope of the analytical tests performed were insufficient to provide reliable evaluation of performance. Some interesting results from the study were: (1) simple statistical procedures may greatly improve the ex-tent and quality of information to be drawn from operational data; (2) there seemed to be a total lack of correlation between final effluent BOD and the sludge loading factor; (3) little or no correlation existed between the SVI and the sludge loading factor; and (4) there was an increase of the SVI with an increase in the sludge return rate. The following conclusions were drawn from the study: (1) low plant effluent quality at the Lakeview Plant is due primarily to specific plant influent charac-teristics; (2) modification of the scope of plant me-tering and sampling procedures, and expansion of the analytical tests is essential to more fully characterize and explain the performance of the treat-ment facilities. (Lowry-Texas) W71-07763

DETERMINATION OF FLOTABLE SUB-STANCES IN WASTE WATER, Sacramento State Coll., Calif. Dept. of Civil En-

gineering.
D. J. Hinrichs, K. D. Kerri, and J. Paterson.
Water and Sewage Works, VOL 118, No 3, p 7074, MAR 1971. 4 FIG, 1 TAB, 3 REF.

Descriptors: *Water analysis, *Flotation, Analytical techniques, Sampling, Stratification, Design criteria, Cost analyses, Economic feasibility, Waste water treatment, *Separation techniques. Identifiers: Flotable solids, Settleable solids.

The presence of flotable solids in waste water, in the form of films and scums, and the resulting design necessary to remove these flotables from the

Group 5D—Waste Treatment Processes

surface and convey them to specialized treatment facilities, has created a need for a specific test to determine the amount of flotables present. In determine the amount of flotables present. In response to this need, an apparatus has been built, and a testing procedure developed. The apparatus consists of two Imhoff cones fastened together at the large ends. The total cost of manufacturing such a device in the laboratory was \$41.00. There are no chemical costs, and thorough cleaning is the only maintenance required. The unit has no instrumentation and draws no electrical power. The test itself requires a minimum of time to perform. Acitself requires a minimum of time to perform. Accuracy is impaired only by the difficulty in obtaining a representative sample, and in keeping the sample mixed before the actual test begins. Collection of a representative sample, however, is a problem pertinent to all waste water examinations, and so should not be included as a drawback for this particular system. Also, the stratification of the sample does not prevent a serious obstacle, since the averaging of several tests will eliminate any in-accuracies due to stratification. (Lowry-Texas) W71-07764

ISOLATION OF POLIOVIRUS FROM DRINK-

Michigan State Univ., East Lansing. Dept. of Microbiology. For primary bibliographic entry see Field 05F. W71-07765

KINETIC CONSTANTS FOR AEROBIC GROWTH OF MICROBIAL POPULATIONS SELECTED WITH VARIOUS SINGLE COMPOUNDS AND WITH MUNICIPAL WASTES AS SUBSTRATES, Oklahoma State Live

Oklahoma State Univ., Stillwater. K. M. Peil, and A. F. Gaudy, Jr. Applied Microbiology, Vol 21, No 2, p 253-256, Feb 1971. 2 fig, 2 tab, 7 ref.

Descriptors: *Kinetic constants, *Aerobic growth, treatment, Organic Heterogeneity, Growth rate, Sewage, Culture, Waste water treatment. Identifiers: Substrates, *Microbial populations.

Previous studies by the authors showed that the Monod relationship (U—Um (S)k sub s..S) best describes the growth of heterogeneous populations in a synthetic waste water containing glucose as the sole carbon source and limiting nutrient. This study is to extend on the usefulness of the above idea by testing the applicability of the Monod equation to heterogeneous populations growing on various substrates. 27 sets of experiments were undertaken, 25 with various pure compounds as sole source of carbon and 2 with sewage. The sewage was concentrated at 65C and 55C. The concentrate was slightly alkaline, pH 8.5. Description of the materials and methods used are given. In general hyper-bolic curves were obtained in plots of U versus S. A table showing values of Um and K sub s is given. Thus the above study concludes that the hyperbolic function can be used to describe the relation between growth kinetics and substrate concentrations for systems which may be heterogeneous with respect to both species of microbe and carbon sources. (Rayaan-Texas) W71-07766

LOW-LEVEL RADIOACTIVE WASTE TREAT-MENTS: THE WATER RECYCLE PROCESS,

Oak Ridge National Lab., Tenn. W. C. Yee, F. Delora, and W. E. Shocker Oak Ridge National Laboratory No ORNL-4472-UC-70-Waste Disposal and Processing. 30 p, 10 fig, 2 tab, 18 ref. AEC Contract No W-7405-eng-26.

Descriptors: *Nuclear power plants, *Water re-use, *Waste water treatment, Water pollution control, Water treatment, Radioisotopes, Detergents, Pilot plants, Ion exchange, Demineralization, Zeta potential, Coagulation, Mixing, Filtration, Membranes, Adsorption, Turbidity.

Identifiers: *Radioactive contaminants, *Decon-

tamination factors.

Re-cycle of water has become increasingly popular, with the atomic energy industry being no excep-tion. A re-cycle process for decontaminating low-level radioactive aqueous wastes and recycling the purified water for re-use at nuclear installations has purified water for re-use at nuclear installations has been successfully developed and demonstrated through several cycles in a micro-pilot plant. The wastes used were ORNL wastes containing low concentrations of salts and radionuclides. The process includes the following steps: (1) clarification; (2) demineralization; and (3) activated carbon treatment. Zeta potential controlled additions of alum, activated silica and nonionic organic polyelectrolyte provided excellent coagulation control. Water in the micro-pilot plant underwent decontamination from all major radionuclides by control. Water in the micro-pilot plant underwent decontamination from all major radionuclides by decontamination factors ranging from 1000 to 10,000 for up to 2400 bed volumes of water. Product water met U. S. Public Health Service Standards for radioactive elements, and the turbidity level of .05JTU is comparable to that of high-quality distilled water. (Lowry-Texas)

QUALITY VERSUS RESIDUAL CHLORINE, Public Health Service, Cincinnati, Ohio. Control Technology Branch. For primary bibliographic entry see Field 05F. W71-07768

MANAGEMENT DECISIONS IN SOLVING WASTE WATER PROBLEMS, Oscar Mayer, and Co., Asilomar, Calif. O. Donald Denker. Water and Scwage Works, Vol 118, No 1, p IW-14-IW-22, Jan 1971. 2 fig, 7 tab.

Descriptors: *Water pollution control, Biochemical oxygen demand, Waste water treatment, Industrial wastes, Biological treatment, Water policy, *Water management (Applied), *Decision mak-

Each company should adopt a water pollution control policy headed by a responsible person who has ready access to top management. At Oscar Mayer and Company the general sanitary engineer keeps the management informed by periodical status research. ports. Samples of such reports are presented. There are four causes for wrong management decisions which are: (1) lack of information, (2) misinformation, (3) information misused, and (4) information not used. Those four causes are discussed with il-lustrative examples. With environmental pollution control affecting plant site selection, a basic policy for site selection is presented with an illustrative example. Though not economical but for the sake of pollution prevention, continuous rendering processes have been used in place of wet rendering. Water conservation and reuse which could be achieved by better design of water using equipment and improving personnel attitude toward conservations. tion should receive more attention from the management. Oscar Mayer and Company re-uses 3.2 MGD of pretreated water. Waste water stream segregation helps achieve effective pretreatment at least cost. Companies should always look into developing their own secondary treatment prior to negotiation with municipalities. A flow chart of Oscar Mayer and Company's waste treatment plant at Madison, Wisconsin which achieves 93.5% BOD removal is shown. (Rayaan-Texas) W71-07770

BOD AND COD ANALYSES ON PARAFFINIC HYDROCARBONS,

University of Western Ontario, London. Biochemical Engineering Group. For primary bibliographic entry see Field 05A. W71-07772

WATER POLLUTION CONTROL AT THE ROHM AND HAAS HOUSTON PLANT, Rohm and Haas Co., Deer Park, Tex. J. W. Parrot, and W. M. Smith.

Water and Sewage Works, Vol 118, No 1, p IW/4-IW/8, Jan 1971. 8 fig, 4 tab.

Descriptors: *Waste water treatment, *Biological treatment, Chemical oxygen demand, Incineration, Organic wastes, Effluents, Suspended solids, Texas, Water pollution control, *Oxidation lagoons, Chemical wastes, *Aeration.
Identifiers: Polymers, Compositing, *Houston

The Houston plant of Rohm and Haas Company is an organic chemical producing plant. It has expanded its treatment facilities three times in eleven years. The latest of these expansions included 3 million gallon aerated lagoons with 1500 hp of floating aerators. The lagoons treat 1400 gpm waste water which is a complex of salt and organic compounds. A chromatogram of a typical sample shows 14 different peaks. A discussion of the COD load is presented with illustrative graphs. The treatment facilities consist of water collection, primary facilities (oil and sludge separation, compositing, neutralization) and secondary (biological) units which are illustrated in the flowsheet. Discussion of the various units is presented. The aerated lagoons were selected in order to obtain relatively low were selected in order to obtain relatively low suspended solids. The total capital investment in waste water handling including sewer system, water treatment plant and waste oil facilities is about \$3,300,000. The cost of waste treatment excluding depreciation is about \$.014/lb of COD removal or \$0.53/1000 gal. of water processed. Disposal of oily wastes including depreciation is \$0.035 gal. (Rayaan-Texas)

LOW TEMPERATURE CATALYTIC OXIDA-TION OF WASTE WATER VAPORS, Acrospace Medical Research Labs., Wright-Patter-son AFB, Ohio.

Courtney A. Metzger, Albert B. Hearld, Bobby J. Reynolds, Bobby G. McMullen, and William H.

Available from the National Technical Information Service as AD-715 286, \$3.00 in paper copy, \$0.95 in microfiche. Aerospace Medical Research Laboratories Report No AMRL-TR-68-48. 13 p, 1 fig, 6 tab, 2 ref. Project No 6373, TASK 04.

Descriptors: *Water reuse, *Catalysts, *Oxidation, *Vapor compression distillation, Urine, Evaporation, Membranes, Filtration, Ammonia, Microorganisms, *Waste water treatment, Temperature, Radioisotopes, Electric power demand. Identifiers: Plate counts, Waste water vapors.

Two low temperature catalytic oxidation systems, designed to oxidize waste water vapors and eliminate trace organic entrainment, were studied climinate trace organic entrainment, were studied with regard to future application to waste water reclamation in space. Formerly, temperatures of 1200F were essential to system operation, thus precluding such a system on the basis of power demand alone. With the development of the two systems tested in this work, catalytic oxidation at 300F was made possible. Development of radioisotope energy for thermal energy also contributed much towards making catalytic oxidation more feasible both from a power and a weight more feasible both from a power and a weight standpoint. Sterile, high quality water was reclaimed by the catalytic oxidation units, used in conjunction with vapor-compression distillation units, and various filtering membranes. Input to the system consisted of urine, washwater, and dehumidification. Output rate varied from 546 ml/hr to 30 ml/hr during a ten day test. Further research is needed on a long term basis to stimulate orbital or space flights of extended duration. However, this is the first known development of a satisfactory low temperature catalytic unit integrated with a vacuum distillation recovery unit, and such a unit could possibly have widespread application. (Lowry-Texas) W71-07774

OZONE GENERATED FROTH FOR SEWAGE TREATMENT,
New Mexico State Univ., University Park. Dept. of

Chemical Engineering.

Joh M. Foulds, Donald B. Wilson, and John W.

Water and Sewage Works, Vol 118, No 3, p 80-83, Mar 1971. 7 fig, 3 tab, 11 ref. FWQA Grant No 1-F1-WP-26, 288-01 and 288-01 A1.

Descriptors: *Foam separation, *Ozone, Laboratory tests, Metals, Sampling, Surfactants, Foaming, Oxidation, Oxygenation, Flow rates, *Chemical oxygen demand, Biochemical oxygen demand, Nitrates, Phosphates, Biodegradation, *Waste water treatment, *Sewage treatment.

The use of ozone as a possible agent for producing a stable controlled foam capable of COD reduction was investigated. A laboratory scale experimental reactor of 5 liter capacity was assembled and moni-tored. Various gas flow rates were used, and there was no temperature control. COD tests were perwas no temperature control. COD tests were performed by the Jeris method, with other examinations conforming to Standard Methods. Addition of salts of Fe (...) and Mn (...) aided in the production of a stable foam which produced an 85% reduction in organic nitrogen, and an 88% reduction in total phosphates, when operated for one hour at a gas flow rate of 1100 ml/min, on trickling filter effluent. The COD reduction of approximately 60% was accomplished after only 20 min. The COD reduction mechanism is complex, however, the major reduction occurs both through chemical oxidation of the substrate, and through separation due to internally generated frothing. (Lowry-Texas) W71-07775

PHARMACEUTICAL WASTE WATER: CHARACTERISTICS AND TREATMENT, Nebraska Univ., Lincoln. Dept. of Civil Engineer-

Ing.
D. R. Anderson, M. J. Hammer, J. G. Obrist, L. E.
Daniels, and C. D. Turner.
Water and Sewage Works, Vol 118, No 3, p IW/2-IW/6, Mar 1971. 3 fig, 2 tab, 4 ref. FWQA Grant
No 5T1-WP-120-02.

Descriptors: *Industrial wastes, *Activated sludge, *Waste water treatment, Fungi, Sludge, Economic feasibility, Pre-treatment (Water), Waste identification, Analytical techniques, Toxicity, Organic loading, Biochemical oxygen demand, Chemical oxygen demand, Nebraska.

Identifiers: *Pharmaceutical wastes, Extended aeration, Treatability studies, Sugar, *Lincoln (Nebr).

A Dorsey Laboratories pharmaceutical formula-tion plant in Lincoln, Nebraska, was experiencing difficulty with their extended acration treatment plant. Operational problems included sludge bulking, excessive solids loss from the system, and concentration of solids in the clarifier. To determine the problem, a comprehensive study was initiated which consisted of three phases: (1) an initial evaluation of the existing treatment system and the influent waste water characteristics; (2) an evaluation of the treatability of the wastes in an extended aeration system in the laboratory under closely controlled conditions; and (3) incorporation of the findings of the two preceding steps in a more detailed field evaluation of the existing facilities. Data produced by all of the studies proved conclusively that due to the variability both of the composition and the flow, and also the effects of certain compounds present in large quantities, the pharmaceutical waste produced at this plant was not amenable to treatment by the extended aeration treatment scheme. The primary reason was the large amounts of sugar in the plant waste which induced the growth of filamentous micro-organisms and upset the plant. Dilution with municipal wastes seems to be the only feasible alternative, and research is continuing along this line. (Lowry-Texas) W71-07776

FLOW REDUCTION OF WASTE WATER FROM HOUSEHOLDS,

General Dynamics Corp., Groton, Conn. Electric

J. Bailey, and H. Wallman.

Water and Sewage Works, Vol 118, No 3, p 68-70, Mar 1971. 4 fig, 8 ref.

Descriptors: *Water conservation, *Water re-use, Waste water treatment, Domestic wastes, Technical feasibility, Cost analysis, *Water utilization, Disinfection Identifiers: Bathing.

Various sources were utilized to establish a water use pattern for an average American family of 2 adults and 2 children. 70% of the total household water intake is consumed in toilet flushing and bathing. Therefore, since this is the largest single area of water use, the greatest savings from applied conservation techniques should be accomplished here. Several plumbing innovations that reduce the amount of water required to transport waste products from the home are presented, as well as water-conserving devices for showers and washing water-conserving devices for snowers and washing machines. A cost analysis revealed, however, that water re-use within the individual home unit is not economically feasible. Water conservation, then, is important in reducing the total volume of flow which requires extensive treatment, thereby easing the burden on many overloaded treatment facilities. The following conclusions were drawn from the preceding study: (1) currently available water saving devices can reduce waste flows from 30 to 50% at little additional cost to the homeowner; (2) limited surveys indicate general public acceptance of such devices; and (3) complete waste treatment and water re-use on a single unit scale does not ap-pear to be practical at this time. (Lowry-Texas) W71-07777

ANAEROBIC SLUDGE DIGESTION, MESO-PHILIC-THERMOPHILIC, Western Kentucky Univ., Bowling Green.

D. R. Rowe.

Water and Sewage Works, Vol 118, No 3, p 74-76, Mar 1971. 2 fig, 1 tab, 8 ref.

Descriptors: *Anaerobic digestion, *Temperature, Methane bacteria, Microorganisms, *Sludge digestion, Alkalinity, Hydrogen ion concentration, Acidity, Nitrates, Nitrites, Ammonia, Methane, *Waste water treatment. Identifiers: Volatile solids, Volatile acids.

Four laboratory scale anacrobic digesters were operated for a 4 week period. Two digesters were operated in thermesophilic range (35C), and two were operated in the thermophilic range (55C) to determine the temperature effects. The progress of digestion was evaluated by the volume of gas produced and by the decrease in volatile solids and the increase in fixed solids. pH, total solids, volatile solids, nitrate, nitrite, ammonia, alkalinity, and volatile acid analyses were performed on the sludge samples, and all determinations were made in accordance with Standard Methods. Overall results showed a higher rate of digestion taking place in the thermophilic digesters. Also, the thermophilic organisms were shown to be more efficient in the removal of nitrate and nitrite nitrogen. The increased efficiency of thermophilic digestion proved that satisfactory results could possibly be obtained in 7-15 days instead of the usual 24-26 days presently used in mesophilic digestion. Therefore, heating of the digesters to the thermophilic range could effectively double the digester capacity of an

RECLAMATION OF POTABLE WATER FROM DOMESTIC SEWAGE,

existing plant without additional construction. (Lowry-Texas)
W71-07778

Ontario Research Foundation, Toronto. F. Besik. Water and Pollution Control, Vol 109, No 4, p 46-

48, Apr 1971.

Descriptors: *Water re-use, *Separation techniques, Reverse osmosis, Activated carbon, Domestic wastes, Adsorption, Filtration, Ion exchange, Bacteria, Disinfection, Colloids, Chemi-*Separation cal oxygen demand, Biochemical oxygen demand, Temperature, Odor, Taste, Color, Turbidity, Ox-idation, *Waste water treatment, *Potable water,

Production of potable water from domestic sewage must include the following steps: (1) separation of suspended and colloidal matter below 5-1 Jones suspended and colloidal matter below 5-1 Jones Turbidity Units; (2) removal of dissolved inorganic solids to below 500 mg/l; (3) reduction of soluble organic carbon material to below 0.2 mg/l; (4) removal of toxic compounds and biocides to within the range of .001-5.0 mg/l; (5) reduction of product temperature to below 15C; (6) elimination of odors, tastes, and colors to limits acceptable to Canadian Drinking Water Standards; and (7) removal of bacterial contamination through adequate disinfection. At the present time, technology has advanced to the point where all of the above limitations can be met through the utilization of available processes. However, being utilization of available processes. However, being technically feasible does not mean that these processes are also economically feasible at the present time. Tables included give itemized listings of the various constituents of domestic sewage, along with the per capita contribution of many common pollutants. (Lowry-Texas)

PAPER MILL WASTE: TREATMENT FOR COLOR REMOVAL, Continental Can Co., Inc., Hodge, La.

Edgar L. Spruill.
Water and Sewage Works, Vol 118, No 3, p IW/15-IW/25, Mar 1971. FWQA Grant No 12040 DRY.

Descriptors: *Color, *Lignins, Pulp and paper industry, *Pulp wastes, Fibers (Plant), Turbidity, Chemical precipitation, Calcium carbonate, Lime, Sludge, Filtration, Industrial wastes, *Waste water

The Kraft pulping process separates lignin from wood cellulose and results in the production of black liquor. This black liquor is not effected by even the most thorough bio-oxidation processes. Alternative treatment methods have been studied. Lime precipitation has been given special attention because of the possibility of recovering it through the pulp mill chemical system. Several variations of lime precipitation were experimented with before the accidental discovery that water containing fiber 'fines' provided good flocculation and removal at moderate lime dosages. Experiments on a wide variety of colored process waste water showed the lime requirements to vary almost, but not quite, directly as the effluent color varied. After color precipitation, the resultant clarified liquid contained nearly half of the lime used. This liquid was reacted with CO2, from kiln stack gas to recover the calcium as calcium carbonate. Recarbonization neutralized the final effluent. The sludges were all processed through the lime kiln, the fiber-lignin sludges burned, and the remaining lime recovered. (Lowry-Texas) W71-07780

METHODS FOR TREATING WASTES FROM WATER TREATMENT PLANTS,

Metcalf and Eddy, Inc.

Stephen L. Bishop.

Journal, New England Water Works Association, Vol 85, No 1, p 10-24, Mar 1971. 6 fig, 3 ref.

Descriptors: *Waste water treatment, *Sludge, Water treatment, New England, Water softening, Coagulation, Flocculation, Sedimentation, Chemical precipitation, Filtration, Centrifugation, Vacuum drying, Freezing, De-watering, Lime, Nutrients, Iron, Manganese, Hardness, Sewers.

The main sources of wastes from water treatment plants include: (1) filter backwash water; (2) coagulation process sludges; (3) softening sludges; (4) sludges from iron and manganese removal plants; (5) diatomaceous earth filtration sludges; and (6) ion exchange brines. For the sludge to be

Group 5D—Waste Treatment Processes

disposed of in landfill areas, it must first be dewatered. The popular cut-off for dewatering processes is 20% solids and a process which cannot concentrate the sludges to 20% solids has no possibility of commercial use. The process achieving the greatest volume reduction at the present time is freezing of the sludge. This method has been suc-cessfully used in Copenhagen since 1963. Labora-tories in the United States have reported volume tories in the United States have reported volume reductions of as much as 86% after the first freezing, with further reductions possible with repeated thawing and re-freezing. Seven other possible disposal methods are; (1) lagoons; (2) drying beds; (3) direct discharge to a sanitary sewer; (4) centrifugation; (5) sludge pressing; (6) vacuum filtration; and (7) alum recovery. No one of these methods is universally applied. In each instance, the particular task to be accomplished, and the economics involved must be carefully considered before a process is selected. (Lowry-Texas) W71-07781

DILUTION OF AN INDUSTRIAL WASTE EF-FLUENT WITH RIVER WATER IN THE VADOSE REGION DURING PIT RECHARGE, Arizona Water Resources Research Center, Tuc-

L. G. Wilson, P. S. Osborne, and D. J. Perciou Office of Saline Water, Grant 14-01-0001-630.
American Society of Agricultural Engineers, 1968
Winter Meeting, Chicago, Illinois. Meeting Paper
No 68-727. 26 p., 8 fig., 3 tab, 10 ref.

Descriptors: *Artificial recharge, *Waste dilution, *Pit recharge, *Water reuse, *Vadose water, Profiles, Potable water, Water quality, Chemical analysis, Groundwater recharge, Pollution abatement, Monitoring, Mixing, Waste disposal, Seepage, Pumping, Salinity, Dispersion, Ephemeral stream, Hydrographs, Industrial wastes, Effluent streams, Water conservation, Waste water disposal, Water management, (Applied), Cooling, water Water management (Applied), Cooling water, Arizona, Arid lands.

Identifiers: *Dilution potential, *Recharge mounds, *Water-content profiles, Recharge trials, Santa Cruz River (Ariz).

Artificial recharge of waste water may conserve rater resources in arid lands. Undiluted blowdown effluent (1000 to 2000 mg/l total dissolved solids-TDS) from industrial cooling towers supplied 15 pit recharge trials from May to August 1968 into 80-foot thick vadose alluvium. Water-content profiles and groundwater hydrographs were observed near the recharge site and the abutting ephemeral stream, the Santa Cruz River (Arizona). The water level below the stream averaged 70 feet. The total quantity of effluent recharge was 40 acre-feet. Dilution of pit-recharged effluent and residual water (700 mg/l TDS) did not occur in the vadose region prior to summer streamflow (400 mg/l TDS), though dilution ensued in downstream groundwater, and in the phraetic region. Pit-recharged effluent was not diluted with streamflow recharge because of high heads in the effluent. After trials, streamflow recharge mixed with the effluent producing lower salinities during the pump-ing operation. Dilution potential of influent seepage is useful in waste disposal or artificial recharge when in place mixing may replace above ground mixing facilities. Recharging of highly concentrated waters should coincide with periods of fully developed river recharge mounds and/or when ephemeral streams are discharging. Pumping as a mixing and blending procedure should be eval-uated. Water-quality monitoring is necessary to avoid potable groundwater contamination. (Popkin-Arizona) W71-07817

OZONATION, NEXT STEP TO WATER PURIFI-

Rene J. Bender. Power, Vol 114, No 8, p 58-60, Aug 1970, 4 fig.

runoff.

Descriptors: *Ozone, *Water purification, *Waste water treatment, Oxidation, Chlorination, Storm

Identifiers: *Overflow purification, Philadelphia.

Ozonation is an outstanding method for purifying water, because ozone is a superior oxidizing agent and oxidation helps clean water thoroughly. Workings of the two types of ozonators are dia-grammed and described. Ozonation is not yet used in the U.S. to purify municipal drinking water because most state laws demand that chlorination be used. Ozonation does not replace chlorination, but it incorporates chlorine into its process in two forms. Ozonation kills bacteria and viruses faster than does chlorination; in addition, ozone does not affect water taste, and it eliminates the slight chlorine taste introduced during primary treatment. Ozonation costs about twice as much as chlorination, but both are very inexpensive. A U.S. trend is now towards ozonation of waste water, and one pilot plant in Philadelphia is designed to purify combined sewer and stormwater discharge when flash floods cause untreated water and sanitary sewage to overflow into rivers. Additional uses of ozone in connection with wastewater are men-W71-07846

FIRESTONE INSTALLS POLLUTION CON-

Oil Gas J, Vol 68, No 35, p 79, Aug 31, 1970.

Descriptors: *Water pollution control, *Treatment facilities, Control systems, Concrete construction, Separation techniques

Identifiers: *Industrial treatment, *Storm water

A water pollution control system, which separates storm and industrial effluent and treats plant waste water before release into the bayou, is being installed. This \$8.8 million operation provides the Firestone plant with a separate industrial effluent collecting system and a separate storm water collecting system, thus the possibility of flushing the two systems together during a heavy rainfall is eliminated.

A PHYSICAL - CHEMICAL SYSTEM FOR TREATMENT OF COMBINED STORM

Committee on Sewerage and Sewage Treatment, Ralph Stone (Chairman) J Sanit Eng Div, Am Soc Civil Engrs, Vol 96, No SA4, Proc Paper 7477, p 993-994, Aug 1970.

Descriptors: Water pollution control, *Sewage treatment, *Activated carbon, *Pilot plants, Laboratory tests, *Waste water treatment. Identifiers: *Storm sewage.

This is a report on ongoing research, conducted by A. J. Shuckrow, G. W. Dawson, and A. T. Brix, covering enumeration and evaluation of the factors which should affect decisions as to the degree of water pollution control required in each specific situation. Powdered activated carbon may be utilized in a physical-chemical process for the treatment of combined storm sewage. The program involves laboratory development of the process, design and construction of a 100,000 gpd mobile pilot plant, and demonstration of the process. The process involves contacting the waste water with powdered activated carbon and subsequent coagulation with alum and a polyelectrolyte followed by high-rate tube settling. The process appears to meet the following desirable characteristics for treatment of combined storm sewage: short detention time, intermittent use with capability to tolerate widely fluctuating flows and waste water composition, small space requirements, high quality effluent, and economical operation. Based on the laboratory findings, the mobile pilot plant is being designed to fit into a standard forty-foot trailer van with the exception of the carbon regeneration facility, which will be skid mounted. The system is designed for maximum operational flexibility and includes turbidity, pH, and flow measuring instruments in addition to the continuous or-ganic carbon analyzer.

PUMP INSTALLATION FOR SEWAGE.

Netherlands Patents .. NL 6817242.

Descriptors: *Patents, *Sewerage, *Pumping plants, Overflow, Pipelines, Waste water treatment *Pumping

This installation is especially good for pumping sewage containing larger sized pieces without separation or processing. The collector feed pipe is connected in normal circumstances to the collecting reservoir by a feed pipe and a pump with its associated suction and delivery pipes. In exceptional conditions the system is connected via an overflow conditions the system is connected via an overflow situated as close as possible above the feed pipe to the sewage pit and consists of an overflow pipe, horizontally below which is fixed a grid, and separated from the incoming liquid flow by a vertical baffle wall which lies along the diameter of the pit and above the feed pipe.

W71-07850

NEW EQUIPMENT-PRIMARY WATER TREATMENT AIDED BY COMPACT SEPARA-TOR.

Chemical Engineering, Vol 77, No 15, p 48-50, Jul 13, 1970. l diag.

Descriptors: *Pollution abatement, *Sewage treat-

ment, *Equipment.
Identifiers: *Waste water concentrator, *Screen

The Waste water Concentrator takes up little space The Waste water Concentrator takes up little space but has the capacity to screen sudden overloads of raw sewage (2,000-3,000 gpm) during rainfall. It provides standby primary treatment by screening influent and then collecting it in an annular chamber and directing it to a discharge box at the bottom of the unit. Materials not passed discharge through a 10-inch pipe. The workings, operating cycle and advantages of the unit are described. cycle, and advantages of the unit are described. W71-07854

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL: WASTE WATER AND STORM FLOW TREATMENT.

Water Pollution Control Fed, Vol 42, No 6, p 963-969, Jul 1970, 42 ref.

Descriptors: Equipment, *Construction materials, *Treatment facilities, Overflow, Construction, Sewers, Technical feasibility, Sewerage, Storm runoff, Separation techniques, Water pollution control, *Waste water treatment.

Identifiers: Treatment methods, Combined sewers.

This section of the review of 1969 literature discusses the construction of new sewerage systems and improvements made in existing systems in large and small cities. New construction methods, materials, and safety programs, are described along with new sewer maintenance and repair programs and methods, and equipment for handling combined sewer overflows including rubber storage tanks, stabilization basins, regulators, treatment facilities, hydraulic additives, pressurized sewers, and the removal of downspout connections. The feasibility of sewer separation, pollution parameters of the property of sewer separation and the sewer separation of the sewer sewers sewers and the sewer sewers s ters from surface runoff, sewer project planning, and changes in sewer systems are other topics included in the literature review on waste water and storm flow W71-07866

CONTRIBUTION TO THE THEORY OF TRICK-LING FILTER PERFORMANCE.

Denver Univ., Colo. Dept. of Chemical Engineer-

Waste Treatment Processes—Group 5D

L. W. Ross.

Water Research, Vol 4, p 517-520, 1970. 3 fig, 5

Descriptors: *Trickling filters, *Kinetics, *Hydraulic properties, Equations, Mathematical models, Correlation analysis, Waste water treatment. Identifiers: Michaelis-Menten kinetics.

The precise definition of kinetic and hydraulic characteristics of the trickling filter is hindered by influences of many variables related to operation, atmosphere, and microbiotic activity. The present note proposes to consider the trickling filter as a homogeneous packed-bed reactor obeying Michaelis-Menton kinetics. On these premises, the BOD removal is approximately linear in the inverse flow rate at high loadings. As indicated by some reports, the BOD removal is independent of loading at low rates and whe process is controlled by diffuat low rates and the process is controlled by diffu-sion. (Wilde-Wisconsin) W71-07877

ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS, Virginia Polytechnic Inst., Blacksburg. Dept. of

James P. Wrightman, Leslie R. Dole, J. Jones, and

Clarence A. King.

Available from the National Technical Information Service as PB-199 267, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Polytechnic Institute and State University Water Resources Research Center Bulletin 42, Feb 1971. 52 p, 12 fig, 16 tab, 14 ref, append. OWRR Project A-026-VA (2).

Descriptors: *Adsorption, *Phenols, *Plastics, *Water pollution treatment, *Water pollution control, Water chemistry, Activated carbon, Sorption, Surfaces, Organic compounds, Waste water treat-Identifiers: Pollutant removal.

Adsorption of phenol from aqueous solutions on solids varying in surface energy was studied using polymers as adsorbents. The amount of phenol adsorbed on silica, carbon, nylon, polyethlene, and Teflon was measured over a wide range of concentrations. The temperature dependence of adsorption was established in the case of carbon. Surface area measure measurements, infrared spectra, and contact angle measurements were used to better define the factors effecting phenol adsorption. The surface areas of Cab-O-Sil, Graphon, Aviamide, Alathon, Microthene, and Teflon were 223, 87, 1.5, 0.10, 0.35 and 8.5 sq m/gm, respectively, measured by either low temperature nitrogen or krypton adsorption. The critical surface tensions of Microthene, Alathon, and Teflon were 35, 31.5, and 28 dynes/cm, respectively. The value for Teflon was anomalously high. The multiple internal reflection infrared spectrum of Microthene showed more adsorption bands than Alathon. No significant temperature dependence was noted in the adsorption of phenol on carbon. The amount of phenol absorbed per unit area by the solid increases as the surface energy of the solid decreases.
(Knapp-USGS)
W71-07910

DEMONSTRATING THE EFFECTS NUTRIENTS IN BIO-OXIDATION RECEIVING STREAMS, POND

Oklahoma Univ., Norman. Bureau of Water Resources Research. For primary bibliographic entry see Field 05C.

W71-07973

COMBINED SEWER OVERFLOW SEMINAR

PAPERS.
Federal Water Pollution Control Administration, Washington, D.C. Div. of Applied Science and Technology.

For primary bibliographic entry see Field 05G.

OVERVIEW OF CONTROL METHODS, Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 05G. W71-07979

STORAGE AND TREATMENT OF COMBINED SEWAGE AS AN ALTERNATE TO SEPARA-

Banister Engineering Co., St. Paul, Minn. For primary bibliographic entry see Field 05G.

POLYMERS FOR SEWER FLOW CONTROL.

Environmental Protection Agency, Washington, D.C., Storm and Combined Sewer Control Branch. For primary bibliographic entry see Field 05G. W71-07981

OVERVIEW OF TREATMENT METHODS,

Environmental Protection Agency, Washington,

Darwin R. Wright. In: Combined Sewer Overflow Seminar Papers, p 53-58, Mar 1970. EPA Program 11020-03/70.

Descriptors: *Overflow, *Treatment, Waste water treatment, Water pollution control. Identifiers: Combined sewers, Treatment methods.

The importance of a varying waste is emphasized in relation to the treatment of combined sewer overflows. The three different treatment methods employed are: physical treatment, biological treatment, and chemical-physical treatment. Examples of these methods are included along with discussions on their results. (See also W71-07978)

MICROSTRAINING WITH OZONATION OR CHLORINATION OF COMBINED SEWER OVERFLOWS,

Crane Co., King of Prussia, Pa. Cochrane Div. For primary bibliographic entry sec Field 05G. W71-07983

OVERVIEW OF COMBINED CONTROL AND TREATMENT METHODS,

Environmental Protection Agency, Washington, D.C. Storm and Combined Sewer Pollution Control

For primary bibliographic entry see Field 05G. W71-07985

ASSESSMENT OF ALTERNATIVE METHODS FOR CONTROL/TREATMENT OF COMBINED SEWER OVERFLOWS FOR WASHINGTON,

Weston (Roy F.), Roslyn, N.Y. For primary bibliographic entry see Field 05G. W71-07986

NEW TECHNOLOGY FOR TREATMENT OF WASTE WATER BY REVERSE OSMOSIS,

Envirogenics Co., El Monte, Calif.

B. S. Fisher, and J. R. J. Lowell.
Copy available from GPO Sup Doc as EP2.10;
17020DUD 09/70, \$0.70; microfiche from NTIS as
PB-199 362, \$0.95. EPA Report 1-66, Sep 1970.
EPA Program No 17020DUD, Contract No 14-12-

Descriptors: *Reverse osmosis, *Separation techniques, Desalination processes, Demineralization, Semi-permeable membranes, Membranes, Cellulose, Phosphates, Nitrates, Temperature, Chemical oxygen demand, Pressure, Tertiary treatment, *Waste water treatment.
Identifiers: *Flux, Total dissolved solids.

Stable, high-flux membranes for waste water renovation by reverse osmosis were required to meet or exceed: (1) fluxes greater than 60 gal/sq ft/day with no more than a 20% increase after one year; (2) rejection of 60% of sodium sulfate. All testing was performed at 600 psi, with 1000 ppm feed solutions. These specifications were met by three cellulose based membranes. Flux losses over short periods were extrapolated to yearly values and ranged from 12-18%. However, periodic cleaning with a laundry enzyme pre-soak was necessary as the flux rates initially declined very rapidly. Cleaning restored the membranes to 80 to 90% of the initial values. Daily cleaning maintained a five day setial values. Daily cleaning maintained a five day series of tests at nearly constant levels. The best of the three membranes tested rejected 90 to 97% of TDS, 70 to 100% of COD, 86 to 96% of ammonium ion, 72 to 99% of nitrate ion, and 97 to 99% of total phosphate. Techniques were explored for at-tachment of proteolytic enzymes to cellulose acetate membranes to render them resistant to colloid fouling. The proteolytic enzyme trypsin was chemically attached to the active layer surface of a membrane prepared from the N-hydroxysuccinimide ester of cellulose acetate hydrogen succinate. The resulting enzymatic membrane displayed hydrolytic activity. No cost estimates were presented for this type of treatment process. (Lowry-Texas) W71-07990

PHOSPHATE STUDY AT THE BALTIMORE BACK RIVER WASTE WATER TREATMENT PLANT

City of Baltimore, Md.

Copy available from GPO Sup Doc as EP2.10; 12010DFV 09/70, \$1.50; microfiche from NTIS as PB-199 363, \$0.95. EPA Report, Sep 1970. 158 p, 16 tab, 33 fig, 14 ref. EPA Program No 12010DFV, Contract No 14-12-471.

Descriptors: *Phosphates, *Activated sludge, Automatic control, Design criteria, Monitoring, Analytical techniques, Sampling, Hydrogen ion concentration, Turbidity, Nitrogen, Chemical oxygen demand, Dissolved oxygen, Oxidation reduction potential, Data processing, Baffles, Aeration, Mixing, Chemical precipitation, Municipal wastes, *Waste water treatment.
Identifiers: Baltimore (Md).

High levels of phosphorus removal have been observed at the Baltimore Sewage Plant in the past. A six month study of the operating conditions and design parameters of two parallel, 10 MGD activated sludge systems was conducted in an attempt to establish the mechanism by which the phosphate was removed. The following variables were used: suspended solids concentration, waste water flow, aeration basin mixing configuration, and dissolved oxygen levels. Both mixing and dissolved oxygen were shown to influence the process greatly. Contact stabilization or step aeration, as opposed to plug flow, caused sharp decreases in the removals, while low dissolved oxygen levels stimulated releases of phosphorus from the sludge. Operating conditions which enhance phosphate removal are standard conditions now at the Baltimore plant. Phosphate removal at Baltimore averaged 82%, compared with 15 to 20% removals for conventional activated sludge, and 9% in Baltimore's trickling filter. No costs analysis was undertaken, since complete removal of the phosphorus involves removal from the sludge supernatant. Some of the parameters which may lead to enhanced phosphate removals have been demonstrated. However, the exact reaction or mechanism by which the removals proceed is still unknown, even though it was established that the calcium removed from the system was not principally by precipitation. (Lowry-Texas) W71-07991

THE BACTERICIDAL EFFECT OF LIME FLOCCULATION/FLOTATION AS A PRIMARY UNIT PROCESS IN A MULTIPLE SYSTEM FOR

Group 5D—Waste Treatment Processes

THE ADVANCED PURIFICATION OF SEWAGE

WORKS EFFLUENT, National Inst. for Water Research, Pretoria (South

Africa). W. O. K. Grabow, Nora A. Grabow, and J. S.

Burger. Water Research, 1969, Vol 3, p 943-953. 6 fig, 1 tab, 25 ref.

Descriptors: *Disinfection, *Bactericide, Hydrogen ion concentration, Alkalinity, Lime, Flotation, Flocculation, Coagulation, Water re-use, Temperature, Analytical techniques, Separation techniques, Sampling, Bacteria, E. Coli, *Waste water treatment.
Identifiers: *Plate counts.

To determine the bactericidal effect of lime in the flocculation/flotation unit under investigation, survival times were recorded for: (1) pure cultures of selected bacterial strains exposed to lime in mem-brane-filtered humus tank effluent (HTE); (2) the bacterial population naturally occurring in HTE exposed to lime in raw HTE; and (3) the bacterial population naturally occurring in HTE exposed to lime in the flotation unit. Reductions occurring in the reactor itself are attributed both to the bactericidal action of lime, and physical removal in coagulation and flocculation. Bacterial reductions of as high as 98% were recorded. Although coliform organisms were reduced 98%, faecal streptococci and staphylococci were reduced only 95.0 and 93.3% respectively under the same conditions. Maintaining the pH at 11.5 for 60 minutes reduced the plate count of the normal mixed culture by 99.0%. Factors affecting the effects of the flotation unit include: (1) presence of organic material; (2) the physiological state of naturally oc-curing bacteria differs from that of organisms grown in 24 hour broth cultures; (3) temperature increases directly increase the bactericidal effect of the lime; and (4) structure of the bacterial cell wall seems to influence the amount of reduction. In an ton/Flocculation will provide not only particulate removal, but high alkalinity will reduce bacterial levels as well. (Lowry-Texas)
W71-07992 actual treatment situation, the Lime Flota-

THE VIROLOGY OF WASTE WATER TREAT-

MENT, National Inst. for Water Research, Pretoria (South Africa). W. O. K. Grabow.

Water Research, 1968, Vol 2, p 675-701, 147 ref.

Descriptors: *Public health, *Viruses, *Waste water treatment, Epidemiology, Activated sludge, Filtration, Adsorption, Hydrogen ion concentration, Temperature, Flotation, Disinfection, Viricides, Ozone, Chlorination, Oxidation, Ultraviolet radiation, Environmental sanitation.

Identifiers: South Africa.

Virology has just recently been endowed with the tools necessary to conduct epidemiological investigations. Within the last 30 years, the development of the electron microscope and of tissue culturing techniques have stimulated interest and concern in the transmission of viruses. Sampling procedures and isolation techniques are presented as background for examining the virology of waste water treatment plants. Examinations have revealed that little or no virus removal takes place in primary settling tanks with detention times of 3 hours or less. Flocculation could possibly concentrate the viruses in the floc, but although as much as 99.6% virus removal has been observed in the laboratory, operating conditions in most plants would preclude efficiencies in that range. Little information has been compiled with regard to viral removals in trickling filters, but the information that is available indicates that little or no removal takes place. Activated sludge data, however, indicates significant antiviral activity, with up to 98% reduction of certain coxsackie viruses. Stabilization ponds and activated carbon demonstrated little effect on viruses, while sand filtration, for many

reasons still unknown, removed nearly all viruses from an inflow of 20,000 PFU/ml during a 7 month investigation. Disinfection with chlorine, iodine, ozone, and ultraviolet radiation was also investigated, with ultraviolet radiation being technically, if not economically, feasible for the job. Viruses are becoming more important in our environment, and much further research is needed for their control. (Lowry-Texas) W71-07993

MIDDLE LEE SETS THE STANDARD, For primary bibliographic entry see Field 05G. W71-07995

WASTE WATER TREATMENT IN GREAT

Commonwealth Associates, Jackson, Mich.

Robert J. Grant. Water and Sewage Works, Vol 117, No 8, p 266-270, Aug 1970. 3 fig, 8 ref.

Descriptors: *Water quality control, *Waste water treatment, Domestic wastes, Industrial wastes, Sewage treatment, Tertiary treatment, Activated sludge, Trickling filters, Filtration, Flocculation, Adsorption, Ion exchange, Reverse osmosis, Nutrients, Sludge, Dewatering, Centrifugation, Incineration, Organic loading, Cost analysis, Storm runoff, Climatic conditions.
Identifiers: *Great Britain.

65% of the domestic sewage of Great Britain is treated and discharged to inland water courses, while the remaining 35% is discharged directly to estuaries or the sea, receiving little or no treatment. Analytical tests performed are those recommended in 'Standard Methods', with few exceptions. Waste water constituents of Britain's domestic sewage differ from those of the United States, because of the difference in diet. Activated sludge, Pasveer oxidation ditches, and low rate trickling filters comprise the bulk of the widely accepted secondary treatment methods. Tertiary treatment methods include microstraining, slow and rapid gravity sand filtration, land irrigation, lagooning and upflow pebble bed clarfiers, while flocculation, foaming, adsorption, reverse osmosis, and electrolysis are in the experimental stage. Sludge treatment has traditionally been accomplished with drying beds. Lack of land has stimulated much interest in mechanical dewatering devices, namely pressure or vacuum fil-tration, polyelectrolyte conditioning, heat treatment, and wet oxidation, and incineration. Problems associated with waste water treatment are not experiencing the same rapid solutions as other technological problems. More effective control and reclamation practices are needed to avoid scrious environmental problems, and progress which has been slow up to now must begin to speed up if the environment is to be saved. (Lowry-Texas) W71-07996

A SOLUTION TO THE PHENOLIC PROBLEM IN FIBERGLASS PLANTS,

Johns-Manville Research and Engineering Center, Manville, N.J.

J. M. Baloga, F. B. Hutto, Jr., and E. I. Merrill. Water and Sewage Works, Vol 118, No 3, p IW/7-IW/11, Mar 1971. FWQA Grant No WPRD87-01-

Descriptors: *Water reuse, *Phenols, Industrial wastes, Flow rate, Turbidity, Toxicity, *Filtration, Separation techniques, Hydrogen ion concentra-tion, *Waste water treatment, New Jersey. Identifiers: *Fiberglass, Suspended solids.

Phenolic resin is used as a binder in the manufacture of fiberglass. Conveyor belts must be flushed with water to prevent this phenolic resin from rendering them inoperable. From this washing operation, 80% of all phenol discharges are originated. The Johns-Manville Co. has developed a process for eliminating phenolic discharges by

reusing phenolic wastes in the plant after filtering them to remove the suspended solids which would otherwise foul the equipment. A small-scale test of the filtration system was conducted. The system consists of a scrap pump, a primary filter, and diatomite pressure filters. Flow rate to the filters is 75 ppm with influent turbidity of 12 mg/l. Effluent turbidity is reduced to 1 to 2 mg/l, eliminating the possibility of the solids fouling equipment during subsequent reuse. Quality of the receiving water has dramatically improved, while water use for the plant has been reduced more than 50%. Product quality has not been impaired by reusing the filquanty has not been impaired by reusing the fil-tered process waters. Net cost savings of \$2700/month have been realized over a 4 month period, attributed mainly to reduction of binder usage by the amount which is recirculated in the fil-tered water. (Lowry-Texas) W71-07997

METROPOLITAN BOSTON'S WASTE WATER QUALITY CONTROL PROGRAM, Massachusetts Metropolitan District Commission,

Francis T. Bergin.

Water and Sewage Works, Vol 117, No 9, p 300-304, Sept 1970.

Descriptors: *Water quality control, *Sewage treatment, Sewers, Tunnels, Design criteria, Sedimentation, Chlorination, Disinfection, Sludge, Scum, Methane, Anaerobic digestion, Incineration, Massachusetts, *Waste water treatment. Identifiers: *Boston (Mass).

The early 1900's saw the city of Boston in a position of leadership in the waste water management area. Failure to keep enlarging their facilities in response to population growth, however, generated unsanitary conditions which resulted in Boston Harbor becoming a large, unhealthy cesspood by the early 1950's. Today, almost twenty years after being ordered to undertake a multi-million dollar pollution control program, Boston has two treat-ment plants, one at Deer Island and one at Nut Island, have a combined capacity of 1036 mgd. These plants provide only primary treatment, with supernatant from the sedimentation basins receiving chlorine before being released on the outgoing tide. Sludge and scum are removed, concentrated, and digested in floating cover, closed digesters. Digester gas produced is used as a power source in the plant for the pumps and aeration blowers. The second phase of the waste water management plan includes the construction of numerous relief sewers, and of several deep tunnels. The sewers bring collected waste water to the tunnels where it is screened and degritted prior to discharge to the downtake tunnels. Relief sewers vary in size from 27 in to 135 in, with approximately 11 miles of 10 ft to 10.5 ft diameter tunnels to collect flow from the relief sewers and convey it to one of the treatment plants. A 233 mgd storm detention and chlorina-tion tank with an expected usage of 22 times yearly has been included to prevent untreated by-passes. The construction of this sewerage system has allowed re-opening of beaches, shellfish, harvesting bed and recreational areas. Much has been accomplished, but much remains to be done. (Lowry-Tex-

W71-07998

BIOLOGICAL TREATMENT OF BLEACH PLANT WASTES,

Prince George Pulp and Paper Ltd. (British Colum-

G. É. Charles, and G. Decker.

Journal Water Pollution Control Federation, Vol 42, No 10, p 1725-1739, Oct 1970. 5 fig, 6 tab, 14

Descriptors: Pulp and paper industry, *Industrial wastes, Water quality control, Salmon, Toxicity, Design criteria, Activated sludge, Neutralization, Oxygenation, Temperature, Hydrogen ion concentration, Biochemical oxygen demand, Aeration, Dissolved oxygen, Nutrients, Phosphates, Ammonia, Lime Slurries, Cost analysis, *Biological treatment, *Pulp wastes, *Waste water treatment. Identifiers: *Bleach plant wastes, Seeding, Fraser River, BOD5, Canada.

Canada's Fraser River is a major salmon producing watershed. When several pulp and paper mills were built, effluent standards were immediately set which included: (1) an aerated basin of 5 day retention time; (2) 60% BOD5 removal; (3) maximum effluent BOD5 of 80 mgl, and (4) effluent diluted to 65% concentration with river water shall not cause mortality to yearling salmon in a 96 hour period. A low-rate activated sludge treatment system consisting of neutralizing, seeding, and aerating was chosen for bleach plant wastes, with the combined system having a detention time of 24 hours. A two year study indicated that both BOD and toxicity levels were within the stipulated limits with the exception of several periods of upset of the system. Unscheduled shut downs were found to decrease the load on the system enough to upset the operation after loading resumed. This problem was solved by the addition of ammonium phosphate to the system at a reduced rate. Nutrient additions were alos found to be necessary, with the ratio of BOD5 removed to nitrogen to phosphorus of 100 to 5 to 1 found to achieve the best results. A D.O. residual of 0.5 mg/l was maintained at all times to facilitate biological treatment. The treatment costs for the system averaged \$1.40/ton of product, the bulk of which goes toward neutralization and nutrient addition. (Lowry-Texas) W71-07999

A STUDY OF THE BIOLOGICAL TREATMENT OF VEGETABLE TANNERY WASTES, West Virginia Univ., Morgantown. Water Research

Dilip Venilal Kalyani.
Master's Thesis, West Virginia University, 1970. 93
p, 20 fig, 19 tab, 34 ref.

Descriptors: *Industrial wastes, *Color, Biodegradation, Bacteria, Acclimatization, Adsorption, Chemical precipitation, Aeration, Respiration, Hydrogen ion concentration, Colloids, *Waste water treatment, West Virginia, *Biological treatment.

Identifiers: *Tannins, *Polymerization, Substrate, Total organic carbon, Matrices, Floc, Frank, Par-

A batch fed biological reactor, using sludge previ-A batch fed biological reactor, using sludge previously acclimated, was used to study the biodegradability of chestnut, wattle, and quebracho tannins. Warburg experiments showed no inhibitory effects for tannins in concentrations of up to 1.5% at pH 7.5. At pH 5.5, however, inhibitory effects were detected at concentrations above 1.25% for non-acclimated sludges. Warburg experiments also established the fact that during respiration, the organisms utilized non-tannin carbons as substrate, and not the tannins themselves. Tannins, as measured by shake-culture experiments and Warburg experiments, are not bioremovable. Decreases in concentration of tannins in a biological reactor are attributed to three factors: (1) quinone polymerization due to autooxidation; (2) adsorption onto the biological floc; and (3) precipitation. Biological activity has no effect upon the color of any of the three tannins tested. Chestnut tannin, containing 42% bio-removable carbon, has the maximum bio-removable carbon, with wattle and quebracho following in that order. However, since tannins are not biodegradable, removals in a biological system must be accounted for by adsorption on the surface of the floc matrix. (Lowry-Texas) W71-08000

MANAGEMENT ATTITUDE TOWARDS WATER CONSERVATION, Shell Canada Ltd., Corunna (Ontario).

For primary bibliographic entry see Field 05G. W71-08001

FROM PROBLEM TO SOLUTION WITH ABS POLYMER WASTE WATER,

Borg-Warner Chemicals and Plastics Group, Washington, W. Va.
D. M. Robinson, and Dennis R. Bolten.

Proceedings, Ontario Industrial Waste Conference 17th, Niagara Falls, Ontario, p 11-29, June 7-10,

Descriptors: *Industrial wastes, Chemical wastes, *Plastics, Sampling, Pilot plants, Design criteria, Activated sludge, Aeration, Sludge, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Analytical techniques, Engineering education, Personnel, *Waste water treatment, *Alkylbenzene sulfonates, West Virginia.

Identifiers: Extended aeration, Treatability studies.

Acrylonitrile-Butadiene-Styrene (ABS) plastics were first introduced in 1948, and were developed and marketed in the late 1950's by Marbon Chemical Division at the Borg-Warner Corp. The manufacturing plants were originally built with facilities for solids removal and pH control. When it became evident that secondary treatment was imperative, a comprehensive sampling program was initiated to monitor: (1) pH; (2) free and total acidity; (3) chlorides; (4) sulfates, (5) suspended, dissolved, and total solids; (6) BOD; and (7) COD. This sampling program was the first step in a four step plan which also included: (1) determination of biodegradability; (2) bench and pilot scale studies to supply information for secondary system process design and (3) preparation of process design. A pilot plant having an aeration basin of 10,000 gallon capacity was operated to supplement lab scale data in developing design equations. The plant was then designed according to these design equations, and has been operating satisfactorily. From this work, two important conclusions were drawn: (1) close co-operation with regulatory agencies benefits both parties; and (2) proper consideration must be given to the education of all operating personnel with regard to environmental protection. (Lowry-Texas) W71-08002

TREATMENT OF DISTILLERY WASTES-A CASE HISTORY, Corby Distilleries Ltd., Corbyville (Ontario).

F. H. Bellstedt, and R. K. Nethercott.
Proceedings, Ontario Industrial Waste Conference,
17th, Niagara Falls, Ontario, p 30-41, June 7-10,

Descriptors: *Industrial waste, *Activated sludge, Aeration, Sludge, Toxicity, Copper, Hydrogen ion concentration, Lime, Fermentation, Chemical oxygen demand, Biochemical oxygen demand, Nutrients, *Waste water treatment. Identifiers: *Distillery wastes, *Shock loading,

The distillation of various grain mashes at Corby Distilleries produced effluents from several sources. These effluents, some of which were concentrates of the original effluent, averaged 600 ppm BOD, 900 ppm COD, 11 ppm nitrogen, and 2.7 ppm of phosphates. The wastes had a pH of 3.5-4.0, but after neutralization, the wastes were found to be amenable to activated sludge biological treatment. After further laboratory and pilot plant analyses, including tests dealing with the presence of copper in the waste water, the treatment plant was designed to include the following: (1) a cooling tower for clean hot wastes handling up to 1170 lm perial Gallons per minute; (2) a cooling and recycling station for polluted hot wastes sized for 700 IGPM; (3) a second station equipped with a sump having an agitator, pH controlled lime feed, and nutrient feed pumps; (4) an aeration basin sized for 200,000 IGPD, 24 hour detention time, and with 2 mechanical aerators transferring 83 lbs oZ/hr; (5) a rectangular clarifier; (6) a 4 ft deep, 1.02 surface acre lagoon providing a 5 day detention time. This system consistently produces an effuent between 30 and 60 ppm COD, 10 ppm BOD or less, and requires no pH adjustment through the plant, and only II ppm nitrogen and 2 ppm of potash for nutriential adjustment. The plant provides a good quality of effluent and shows good resilience in periods of overloading. (Lowry-Texas) W71-08003

CONSERVATION, RECLAMATION AND RE-USE OF SOLIDS AND WATER IN POTATO PROCESSING, Manitoba Univ., Winnipeg. For primary bibliographic entry see Field 05G. W71-08004

REVERSE OSMOSIS-A REVIEW OF ITS APPLICATIONS TO WASTE TREATMENT,

Ontario Research Foundation, Sheridan Park. A. Golomb, and F. Besik.

Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 67-96, June 7-10, 1970.

Descriptors: *Reverse osmosis, *Separation techniques, Water purification, Permeability, *Membranes, Water reuse, Desalination, Industrial wastes, Chemical wastes, Mine drainage, *Waste water treatment, Membrane processes.

Identifiers: Ultrafiltration, Flux, Power require-

Reverse osmosis membrane systems are currently classified in 5 major categories: (1) tubular units; (2) spiral-wound units, (3) plate and frame reverse osmosis units; (4) plate and frame ultrafiltration units; and (5) hollow fibre units. A brief description of each type of unit is presented along with its advantages and disadvantages. Reverse osmosis (and/or ultrafiltration units) have been successfully applied in the treatment of: (1) spent liquors from (and/or ultrafiltration units) have been successfully applied in the treatment of: (1) spent liquors from the pulping industry; (2) acid mine drainage waters; (3) petrochemical complex waste waters; (4) electroplating waste waters; (5) cheese whey waste streams; (6) corn processing effluents; (7) high salinty irrigation return flows; and (8) various other miscellaneous industrial waste treatment applications. The principal advantages of reverse os-mosis units lie in the low power or fuel costs, as opposed to distillation. Continuing research in this area should inevitably result in better membrane materials and decreased cost, making possible the addition of even more areas to the ever growing list of areas of application. (Lowry-Texas) W71-08006

A NOVEL ION EXCHANGE PROCESS FOR CHEMICAL RECOVERY AND POLLUTION ABATEMENT,

Ontario Paper Co., Ltd., Thorold.
D. Craig, and C. D. Logan.
Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 98-108, June 7-10, 1970. 3 fig, 4 ref.

Descriptors: *Industrial wastes, *Pulp and paper industry, Separation techniques, *Water reuse, lon exchange, Resins, Adsorption, Chemical precipitation, Sedimentation, Fermentation, Alcohols, Acids, Automatic control, Chemical wastes, *Waste water treatment.

Identifiers: Sodium hydroxide, Regeneration.

The Ontario Paper Company, Limited has used recovery methods to reduce the amount of pollutants discharged from heir pulping processes. In 1943, they pioneered the production of ethyl alcohol from spent sulfite liquors in North America, and today remove in excess of 25 tons of fermenta-ble sugars/day. In 1952, vanillin productionas begun in order to utilize the lignin present in process wastes. At present, the company is involved in a three phase development program to reduce suspended and dissolved solids in the effluent. These three steps include: (1) a 105 inch diameter settler removing 11 tons of suspended solids per day; (2) an ion exchange process; and (3) construction for evaporation and burning of the effluents. Total cost of the project is \$8.6 million.

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The ion exchange process involves 4 steps: (1) adsorption of alkaline vanillin process liquor in an upflow ion exchange bed at Amberlite IRC-50; (2) water washing of the resin to free it of the liquor; (3) regeneration of the resin with sodium bisulphite and sulphurous acid to elute the Na and restore the resin to its hydrogen form; (4) water washing to displace the regenerant. The three column system is totally automatic, and it can recover 30 ions/day of equivalent NaOH for subsequent in-plant reuse. Additional capacity for up to 65 tons/day recovery is available in response to increased demand. (Lowry-Texas) W71-08007

APPLICATION OF AUTOMATIC SAMPLING TO TODAY'S WATER QUALITY CONTROL PROGRAMS,

Gurnhamand Associates, Inc. Chicago, Ill. For primary bibliographic entry see Field 05G. W71-08008

MINEWATER TREATMENT-INCO SUDBURY DISTRICT OPERATIONS, International Nickel Co., of Canada Ltd., Toronto

C. Ferguson, and M. Morris.
Proceedings, Ontario Industrial Waste Conference,
17th, Niagara Falls, Ontario, p 119-132, June 7-10,
1970. 10 fig, 3 ref.

Descriptors: *Acid mine water, *Sulfides, *Mine drainage, Leaching, Chemical precipitation, Lime, Sedimentation, Baffles, Sludge, Copper, Iron, Ponds, Water pollution control, Nickel, *Waste water treatment, Standards.

Identifiers: Water quality standards, Sudbury (On-

The International Nickel Company has 9 operating mines, four concentrators, two smelters, an iron ore recovery plant, and a copper refinery in the Sudbury area. The output of these mines is 95,000 tons per operating day. Waters contacting the orebody leach out base metal sulphides, primarily copper, nickel, and iron, resulting in acid mine water. Criteria for discharge of mine water is 1 mg/l, 1 mg/l, and 17 mg/l of copper, nickel, and iron, respectively, with a pH to range from 5.5 to 10.6. To produce water consistent with the standards set by the Ontario Water Resources Commisvarious treatment schemes have developed and tested. The advent of hydraulically placed cemented backfills solved many settling problems, but produced sludge handling problems as well due to a greater volume of sludge. Chemical treatment was also required to reduce the dissolved metals in solution to acceptable levels. The final design used was either in series or in parallel to provide detention times from 10 to 20 days. With 10 day detention time, and an addition of 1200 lbs/day of lime, the content of nickel was reduced from 40 to 50 mg/l to less than 1 mg/l, with copper and iron being low in concentration before treatment. At present, research is continuing in the field of un-derflow disposal. Attempts are being made to over-come the handling problems that prevent this high grade material from yielding a direct profit return. (Lowry-Texas) W71-08009

DEEP BED FILTRATION OF STEEL MILL EF-FLUENTS,

Dravo Corp., Pittsburgh, Pa.

E. S. Savage

Proceedings, Ontario Industrial Waste Conference. 17th, Niagara Falls, Ontario, p 133-156, June 7-10,

Descriptors: *Separation techniques, *Filtration, Industrial wastes, Oil, Iron, Hydrogen ion concentration, Automatic control, Baffles, Pressure, Headloss, Water reuse, Particle shape, Particle size, *Waste water treatment, *Steel.

Identifiers: *Deep bed filtration, Millscale, Solids loading, Filter media, Backwashing, Bed expan-

Deep bed filtration utilizes the entire bed of the filter for solids separation, with solids removal tak-ing place at the voids of the media and not at the media surface. The actual removal mechanisms are not clearly understood, but they seem to be a combination of surface forces, gravity, interception, hydrodynamics, and several others. Since removal occurs within the bed, backwashing arrangements are of great importance in determining the final water quality. Dravo Corporation has successfully utilized deep bed filtration in the final treatment of mill scale and oily waters from steel mill hot rolling systems. Specific loading of 5 to 10 lbs of solids per square foot of filter area are commonly used in mill scale filtration and loading from 1 to 5 lbs solids/ft sq. are common for sewage effluent polishing and process water filtration. Design has commonly proceeded by the rule of thumb method with consequent expensive over-design. Increased un-derstanding of the mechanisms involved, along with pilot scale data allow more optimization of fullscale systems at considerable savings to the in-dustry and with no sacrifice of effluent quality. A case history is presented to substantiate the op-timization techniques. (Lowry-Texas)

BIOLOGICAL SURVEY OF THE EFFECTS OF URANIUM MILLING WASTES ON THE WATER QUALITY OF THE SERPENT RIVER BASIN,

Ontario Water Resources Commission, Toronto.

Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 157-178, June 7-10, 1970. 8 fig, 8 tab, 8 ref.

Descriptors: *Acid mine water, *Industrial wastes, Fish, Zooplankton, Chemical precipitation, Neutralization, Ion exchange, *Sampling, *Moni-toring, Analytical techniques, Hardness (Water), Alkalinity, Acidity, Hydrogen ion concentration, Lime, Water quality control, Water pollution sources.

Identifiers: *Organic carbon, Dissolved solids,

Effluents from uranium mines containing acidic compounds have lowered the pH and alkalinity of several lakes in Canada. This lower pH has caused a decrease in the inorganic carbon content of the lake waters, and a corresponding decrease in the planktonic life of the lakes. This decrease in plankton has caused a decrease in game fish which has retarded recreational use of the waters. The preceding conclusions were arrived at by the Ontario Water Resources Commission after three years of observing, sampling, and analyzing the biota of Lakes Quirke, Whiskey, Pecors, Elliot, Dunlop, and Teasdale. No statements were released regarding radioactivity levels until their contribution was thoroughly assessed. The following recommendations emanated from the preceding study: (1) tailings effluents should have pH between 6.8 and 8.0 at point of entrance to receiving waters: (2) automatic monitoring devices for measurement of pH and both dissolved and suspended solids should be required to insure compliance with OWRC standards; (3) the mining in-dustry should investigate methods of restoring the affected lakes to their original pH condition; and (4) the following standards for discharge of mine wastes to poorly buffered waters should be observed, a pH of 6.8 to 8.0, less than 20 ppm sulfates, 1 ppm nitrates, 25 ppm total hardness and 75 ppm total dissolved solids. (Lowry-Texas) W71-08011

A PRACTICAL APPROACH TO THE FILTRA-TION OF METAL HYDROXIDES,

Northern Electric Co., Ltd., London (England). R. S. Cuthbertson, and E. B. Hettwer.
Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 178-193, June 7-10,

Descriptors: *Separation techniques, *Filtration. Chemical wastes, Industrial wastes, Flocculation,

Sedimentation, Oxidation-reduction potential, Oxidation, Toxicity, Acidity, Hydrogen ion concentra-tion, Neutralization, Corrosion, Polyelectrolyte, Stainless steel, Sludge, Cost analysis, *Waste water treatment.

Identifiers: *Plating wastes, Cyanides, Suspended solids, London, Ontario, Canada, Polyelectrolyte.

Northern Electric Co. produces telephone set parts plated with copper, nickel, chrome, zinc, tin, gold, and silver. Plating wastes include all these metals plus cyanide, chromic acid, and hot mineral acids. Standard chemical precipitations are used to remove the heavy metal and their salts, but high suspended solids concentrations prevent direct discharge of the effluent to a receiving water. A pressure filtration unit designed for a loading of .17 gpm/ft sq. and using a 1200 gallon pre-coat tank, a 150 gpm, 50 psi head pre-coat pump and a 300 gallon body feed tank and 350 ft sq of filter area was constructed. The system was a total failure both from operational and financial standpoint. After consulting other producers about treatment of plating wastes, and engaging a consultant, the following modifications were developed: (1) filter septums of dacron were changed to stainless steel mesh; (2) asbestos fibres were used as pre-coat because of ease of maintenance; (3) flow was regulated from 4-50 gpm; (4) a stand-by sedimentation tank was constructed to allow as much as 60% of flow to setthe by gravity and by-pass the filter; (5) polyelectrolyte flocculant aid was added to facilitate settling. Costs for this system are estimated at \$77/week, which, based on a 300,000 cellect flow. \$77/week, which, based on a 300,000 gallon flow is \$.23/1000 gallon of effluent with a dry sludge production of 1 ton of solids. Future work is to be directed toward enlarging the settling tank for increased detention time, and increased sludge holding facilities are also planned. (Lowry-Texas) W71-08012

CHRYSLER CANADA LTD. INDUSTRIAL WASTE TREATMENT PLANT, WINDSOR, ON-TARIO,

Chrysler Canada Ltd., Windsor (Ontario).

D. O. Osmun.

Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 194-213, June 7-10, 1970. 4 ref.

Descriptors: *Oil wastes, Sedimentation, Flotation, Neutralization, Flocculation, Incineration, Alalinity, Acidity, Hydrogen ion concentration, Corrosion, Cost analysis, Sludge, Sampling, Analytical techniques, *Chemical wastes, *Industrial wastes, Waste water treatment, *Treatment facilities. Identifiers: Canada

Expansion of the Chrysler Canada Ltd., Windsor, Ontario plant necessitated the development of a waste water treatment facility. The preliminary studies on the problem were conducted by a consulting engineering firm. The plant was designed and built at a total cost of \$3,140,000, and close supervision of detail was provided by Chrysler Canada Ltd in an effort to keep costs down without sacrificing plant efficiency or capacity. A three stage em was developed to treat effluents containing welding coolants, acid washwater, phosphate dip, caustic dip, anti-freeze, gasoline, emulsified cleaners, paints, free and soluble oils, and heavy suspended solids. Stage one consists of 4 batch clarifier tanks utilizing sulfuric acid to break out the oil. The resultant solids are then settled, filtered, and trucked to a municipal landfill. Stage two involves removal of suspended solids by chemical reaction and air flotation. The floated floc is removed by skimming, concentrated, and in-cinerated. Stage three is a solids contact clarifier employing alum and coagulant aid to form a sludge, and lime or caustic soda to control pH. Plant capacity is rated at 2,200,000 gallons on a 16 hour day which can be increased to 3,000,000 gallons by running 24 hours/day. All sludge waste materials with the exception of grit and heavy solids are incinerated. Chemical cost averages 15 cents to 30 cents/1000 gallons. Sampling on influent and effluent is automatic, and all samples are analyzed

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for: (1) SS; (2) oils, (3) pH, (4) settling rate, (5) alkalinity; (6) temperature, (7) other chemicals if suspected. Water which does not meet effluent requirements is stored and treated again. (Lowry-W71-08013

OPERATIONAL GROWING PAINS OF AN IN-DUSTRIAL WASTE TREATMENT PLANT, RCA Corp., Ltd., Midland (Ontario). H. G. Cox.

Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 214-222, June 7-10,

Descriptors: *Chemical wastes, *Industrial wastes, *Waste water treatment, Automatic control, Sampling, Hydrogen ion concentration, Acidity, Alkalinity, Chromium, Toxicity, Diatomaceous earth, Filtration, Sedimentation, Demineralization, Neutralization, Lagoons, Pumps, Stainless steel, Maintenance, Personnel, Cost analysis, *Treatment facilities.
Identifiers: *Suspended solids, Canada.

The RCA Ltd. plant at Midland, Ontario is situated in a highly scenic recreational area where pollution control of both air and water is essential. The plant produces only color television picture tubes. Effluents from the plant contain mostly acid and alkali wash and rinse waters. The sewers are broken down into categories: (1) sanitary sewers con-nected to the town of Midland sewerage system; (2) clear water drains for roof drains and untreated cooling waters; (3) caustic drains; and (4) saranlined steel pipe acid drains. The treatment system consists of holding tanks, chrome reduction tanks, neutralization tanks, three diatomaceous earth pressure filters, and storage lagoons. The problems involved with the start up, and the continued operation of the plant are discussed along with the remedial action taken. Problems ranged from those associated with overflow caused by undersized lines to those stemming from laundry shrinking of dacron filter bags. 50 million U. S. Gallons were treated in 1969 at a total cost including depreciation and overhead of about \$1.40 per thousand gallons. Operational improvements and increased main plant load are expected to reduce the cost to somewhere around \$1.00/1000 gallons in the near future. (Lowry-Texas) W71-08014

PILOT PLANT STUDIES ON COMBINED DOMESTIC AND PAPER MILL WASTES,

O'Brien and Gere, Syracuse, N.Y

John J. Keegan.

Ontario Industrial Waste Conference, 15th, p 78-93, June 1968. 8 fig, 4 tab.

Descriptors: *Biochemical oxygen demand, *Domestic wastes, Pilot plant, Design, Pulp and paper industry, Economics, Activated sludge, Stabilization, Effluent standards, Pulp wastes, *Waste

water treatment. Identifiers: *Suspended solids, Press effluent.

A New York law calling for 85% BOD and SS removal from all effluents brought about a joint waste water treatment study. A pilot plant was constructed to determine process design parameters for the treatment of combined domestic and paper mill wastes in the city of Plattsburgh. The study was of two steps, the first was a feasibility and economic study and the second was the pilot plant. Preliminary study and site limitations determined the use of the activated studge process. Discharge from mill No. 2 (press effluent) which is only 1% of the total flow but contains 50% of the organic load presented a special problem. Design was made so the plant will operate both with or without the press effluent. Conventional activated sludge was used but the contact stabilization modification was evaluated because of possible savings on the volume of the aeration tank. Results from the conventional process indicated that an excess of 90% BOD removal can be achieved with loading on the aeration tank below .7 lb BOD/No. MLSS. Results from the modified process indicated that 92% BOD removal from all sources could be obtained at 3 hour contact time and 3 hours stabilization time which indicates no significant economic advantage over the conventional process. A thorough discussion of the two processes including tables, graphs, and schematic diagrams is presented. (Rayyan-Texas)

ACTIVATED SLUDGE SYSTEM VARIATIONS, SPECIFIC APPLICATIONS,

Associated Engineering Services Ltd., Vancouver (British Columbia).

J. M. Stewart.
Proceedings, Ontario Industrial Waste Conference, 15th, p 93-115, June 9-12, 1968. 16 fig, 14 ref.

Descriptors: *Kinetics, *Biological properties *Physical properties, Mathematics, Synthesis, Respiration, *Activated sludge, Wastes, Aeration, Biochemical oxygen demand, Oil, Stabilization, *Sludge treatment, Waste water treatment. Identifiers: Suspended solids (SS).

To understand how the characteristics and desired degree of treatment can determine the system design requirements, an understanding of the system reaction kinetics is necessary. The physical and biological reactions are discussed with mathematical and stoichiometric equations which cover energy production, protoplasm synthesis and en-dogeneous respiration. Sludge produced by extended aeration is considerably less than that produced in short term or conventional systems. Mathematical relations describing the reaction Mathematical relations describing the reaction kinetics in a soluble and a soluble plus particulate wastes receiving system are presented. After reviewing the conventional activated sludge system, specific application of the activated sludge. to suit various types of wastes are presented. The step aeration has the advantage of carrying higher weights of organisms in the system than a conventional system, while still maintaining a lower SS load on the clarifier. Contact stabilization, although it permits the use of the same loading factor of the conventional system, allows up to twice the volumetric loading. It is ideally suited to treatment of waste water in which a large portion of the BOD is present in suspended or colloidal form. The water cooling tower is suitable for treating refinery or petrochemical waste water. Those three systems and five more: Hatfield-Kraus, activated aeration, short term aeration, extended aeration, and aerated lagoons are discussed with their flow diagrams. (Rayyan-Texas) W71-08018

NEW APPROACHES TO WASTE WATER TREATMENT,

Cincinnati Water Research Lab., Ohio.

Charles L. Swanson.

Proceedings, Ontario Industrial Waste Conference, 15th, p 117-145, June 9-12, 1968. 9 fig, 4 tab, 10

Descriptors: *Waste water treatment, *Biochemical oxygen demand, Effluent, Pollutants, Biological treatment, Phosphate, Nitrogen, Screens, Sedimentation, *Filtration, Osmosis. Identifiers: *Suspended solids (SS).

Conventional waste treatment processes are highly effective in removing BOD and SS but not to the extent to make the effluent suitable for reuse application. A table summarizing the waste water pollutants and applicable treatment processes is presented. A discussion on the stage of development of various processes and alternative treatment techniques available or being developed is included. Those processes include: (1) conventional biological treatment, (2) SS and particulate BOD removal, (3) phosphate removal, (4) nitrogen removal, (5) refractory organic removal, and (6) dissolved inorganic removal. These processes are discussed in detail including estimated costs. For example, SS and particulate BOD removal could be achieved by screening at a cost of \$0.015/1000 gallons or by filtration at a cost of \$0.025/1000 gallons. Removal of dissolved inorganics by electrodialysis is estimated at \$0.141/1000 gallons while by ion exchange it is \$0.25/1000 gallons. All these estimated costs are summarized in one table. Generally speaking the cost of complete treatment beyond conventional processes for removal of nutrients, organics, and inorganics is estimated at \$0.26-0.30/1000 gallons as compared to an average of \$0.11/1000 gallons for secondary treatment. However, the fact that water produced from complete treatment methods is potable, and therefore salable, should help to ease the financial burden. (Rayyan-Texas) den. (Rayyan-Texas) W71-08019

PHOSPHATE REMOVAL BY ACID HYDROLY-SIS AND CHEMICAL PRECIPITATION, Ryckman, Edgerly, Tomlinson and Associates, Inc., St. Louis, Mo. Cecil Lue-Hing, H. D. Tomlinson, and D. W.

Ryckman.

Proceedings, Ontario Industrial Waste Conference, 15th, p 203-215, June 9-12, 1968. 7 fig, 12 ref.

Descriptors: *Phosphates, Lime, Acid, Catalysts, Solvent, Colloids, Cations, Enzymes, Hydrogen ion concentration, Temperature, Oxidation, *Waste water treatment, *Organophosphorus compounds, *Chemical precipitation, *Chemical degradation.

Most of the present phosphate removal methods are limited to inorganic phosphates with 100 mg/l concentration utilizing lime within a pH range of concentration utilizing lime within a pH range of pH 8-pH 11 or adsorption and precipitation. This method 'Acid catalyzed Hydrolytic Degradation and Chemical Precipitation' is effective for both industrial and domestic wastes rich in organic phosphates. The factors governing the rate hydrolysis of organophosphates are: (1) pH, (2) temperature, (3) type and concentration of catalysts, (4) structure of compound, (5) type of solvent, (6) colodial gels, (7) complexing cations, and (8) enzymes. The steps used in this process are: after adjusting the waste water to a predetermined pH at justing the waste water to a predetermined pH at ambient temperature and reacting with hydrated lime an insoluble precipitate of calcium phosphate will form which is then flocculated and removed as sludge in the primary sedimentation unit. The phosphate free effluent is released to the other units for further treatment as required. The projected cost of acid processing appears more favora-ble especially in terms of lime requirements, since it requires less than 25% of the lime used in other processes per unit weight of PO4 removed. Alkaline removal of phosphate as well as all chemical phosphate removal processes in use produce calcium phosphate precipitate in subsequent biological oxidation systems. (Rayyan-Texas) W71-08022

KINETIC STUDIES OF THE OXIDATIVE DEGRADATION OF DETERGENT AND RELATED SPECIES IN AQUEOUS SOLUTION. I. MICROBIOLOGICAL STUDIES,

Maryland Univ., Baltimore. Dept. of Microbiology. Marilyn J. Ripin, Kerry F. Noon, and Thomas M. Cook

Available from the National Technical Information Available from the National Technical Information Service as PB-199 365, \$3.00 in paper copy, \$0.95 in microfiche. University of Maryland Water Resources Research Center, Completion Report, Sept 1970. 69 p 14 fig, 13 tab, 32 ref.

Descriptors: *Detergents, *Biodegradation, *Bacteria, *Cultures, Linear alkylate sulfonates, Oxidation, Microbiology, Kinetics, Model studies, En-

Identifiers: *Pseudomonas testosteroni, Alkylaryl-sulfonates, Arylsulfonates, Catechol, Benzene sulfonate, p-toluene sulfonate.

A model simulating bacterial degradation of LAS detergents was devised by employing simpler compounds, benzene sulfonate and p-toluene sulfonate,

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as the sole sources of carbon and sulfur. This substitution permitted observation of alkylarylsulfonate oxidation by a single species of bacteria, identified as Pseudomonas testosteroni. The recorded features of the biodegradation process inrecorded reatures of the blodegradation process included effect of substrates and buffers, growth kinetics, cells' respiratory activity, and the influence of inhibitors. Results suggested that catechol or corresponding alkyl derivatives form intermediate products, and that the reaction involves participation of at least one enzyme, catechol-2,3-dioxygenase. Oxidation of catechol via a meta cleavage enzyme has been demonstrated. via a meta cleavage enzyme has been demonstrated with whole cells, as well as cell-free extracts. Biodegradation of linear alkylate sulfonate detergents was achieved only with mixed bacterial cultures. (Wilde-Wisconsin) W71-08029

RECLAMATION OF WASTE WATER FOR WELL INJECTION,

Los Angeles County Flood Control District, Calif.; and California Inst. of Tech., Pasadena. W. M. Keck Lab. of Environmental Health Engineering. John K. Mitchell, and William R. Samples. Los Angeles County Flood Control District, California, Feb 1967. 250 p, 32 fig, 57 tab, 14 ref. Partially supported by a research grant by the US Public Health Service.

Descriptors: *Water reuse, *Injection, *Tertiary treatment, *Filters, *Waste water treatment, *Recharge wells, Injection wells, California, Groundwater, Saline water intrusion, Water purification, Sewage treatment, Water Reclaimed water, On-site investigations. supply. Identifiers: *Los Angeles, Hyperion plant.

The Los Angeles Flood Control District reports its investigation of high-rate treatment facilities to polish standard-rate activated sludge effluent to make it suitable for use as a water supply for recharge through injection wells. Previous testing by the District using slow sand filtration for Hyperion effluent indicated that a satisfactory water could be provided. Due to the unavailable large land area required by this system, the present test was undertaken to demonstrate the potential of high rate filtration. The investigation conducted at the City of Los Angeles Hyperion Treatment Plant had three basic phases. First was tertiary treatment to polish the standard rate activated sludge effluent. The facilities used for this consisted of parallel operation of a rapid sand filter, pressure sand filter, and a diatomaceous earth filter. Second, the polished water from one of the filters was stored in a reservoir and then recharged into a test site injection well. Third, observation wells were used to monitor the water quality as it moved through the underground aquifer. Either rapid sand filtration with pretreatment or diatomaceous earth filtration can be used to produce water from Hyperion secondary effluent which is acceptable for injection. The estimated cost is \$24 per acrefoot. Further testing of water reclamation and injection, on a larger scale, is recommended. It is suggested that the District cooperate with other agencies to make reclaimed water available for operation of the fresh water barriers which are maintained to prevent sea water intrusion. (Poertner) W71-08124

COST OF MUNICIPAL SEWAGE TREATMENT PLANTS IN ILLINOIS,

Illinois State Water Survey, Urbana. Thomas A. Butts, and Ralph L. Evans. Illinois Department of Registration and Education, Springfield, Circular 99, 1970. 37 p, 16 fig, 12 tab,

Descriptors: *Construction costs, *Treatment facilities, *Sewage treatment, *Cost comparisons, *Cost analysis, Municipal wastes, Waste water treatment, Least squares method, Regression analysis, Estimated costs, Illinois, Cities Identifiers: *Sewage treatment plant costs.

Construction costs are summarized for 291 municipal sewage treatment plants built in Illinois between 1957 and 1968. Most of the plants were built under the Federal Construction Grants Program (Public Law 660). Least squares regression analysis was used to relate design population equivalents to either unit costs in terms of dollars per design equivalent or total costs in terms of dollars. The data were categorized into eight classifi-cations for new plants and two for plant additions. Also, regression equations were developed for esti-mating lagoon land costs, plant operating costs, and FWPCA construction cost indexes. Use of information presented in this circular should provide reasonable estimates of the initial investments involved in constructing and equipping sewage treatment plants in the State. Sample cost estimates are given for each type of plant analyzed. These esti-mates are not alternatives to detailed engineering cost analyses; rather, they are intended to permit reasonable estimates with a minimum of effort for comparative purposes. Cost figures and design criteria were supplied by consulting engineers, the Illinois Sanitary Water Board, and the Great Lakes Regional Office of the Federal Water Pollution Control Administration. Approximately 325 projects were reviewed, and the data for 291 were considered adequate for statistical analysis. (Poertner) W71-08130

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE, VOLUME 1, SUMMARY SUP-PLEMENT.

Fresno County Planning Dept., Calif. For primary bibliographic entry see Field 06B. W71-08178

DESIGN OF SEWER SYSTEMS.

Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
For primary bibliographic entry see Field 05G.
W71-08199

DESORPTION OF AMMONIA FROM ANAERO-BIC LAGOON.

lowa State Univ., Ames. Dept. of Agricultural Engineering. J. K. Koelliker, and J. R. Miner.

Journal Paper No J-6873 of Iowa Agricultural and Home Economics Experiment Station, Ames. Paper presented 1971 Mid-Central Meeting, American Society Agricultural Engineers, Paper No MC-71-804. 21 p, 6 fig, 2 tab, 9 ref. USDI Public Law 88-379, HEW EC 00283-02.

Descriptors: *Farm wastes, *Anaerobic digestion, Farm lagoons, Biodegradation, Ammonia, Hogs, Disposal, Temperature, Hydrogen ion concentration, Nitrogen cycle, Nitrogen compounds, Laboratory tests, *Mass transfer, *Waste water treatment. Identifiers: *Anaerobic lagoons, *Nitrogen Identifiers: *Anaerobic lagoons, *Nitrogen balance, Ammonia desorption, Nitrogen transformations, Swine.

The loss of ammonia from an anaerobic manure lagoon has been monitored by measurement of ammonia concentrations in air surrounding the lagoon and by a nitrogen balance for the same lagoon from Nov. 1969 - Oct. 1970. Theoretical considerations of desorption and data from the lagoon indicate that the nitrogen loss to the air can be predicted. An anaerobic lagoon may well be a nitrogen sink if no liquid must be removed from it. The rate of ammonia desorption from a lagoon surface is accelerated by increasing alkaline pH, higher temperatures, and increasing wind (Christenbury-Iowa State) W71-08207

NUTRIENTS IN EFFLUENTS FROM ANIMAL

PRODUCTION AREAS,
Missouri Univ., Columbia. Dept. of Agricultural
Engineering; and North Carolina State Univ.,

Jackie W. D. Robbins, George J. Kriz, and David H. Howells.

Paper presented at 1971 Mid-Central Meeting American Scociety Agricultural Engineers, Paper No MC-71-102. 20 p. 5 fig, 4 tab, 10 ref.

Descriptors: *Farm wastes, *Nutrients, *Coliforms, *Runoff, Management, Phosphate, Nitrogen, Biochemical oxygen demand, Bacteria, Farm lagoons, Pollutants, Disposal, Hogs, Poultry, Cattle, Waste water treatment.
Identifiers: Total coliform, Fecal coliform, Swine, Total Organic Carbon (TOC).

Twelve typical agricultural areas representing three types of animal waste management techniquesland spreading including pasture and drylot units, lagooning and direct discharge into streams—were studied to determine the amounts of and factors governing stream enrichment from swine, dairy, poultry and beef production operations. (Christenbury-Iowa State) W71-08208

FARM ANIMAL-WASTE MANAGEMENT.
lowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05G. W71-08209

DEHYDRATING **POULTRY** COST OF MANURE.

Poultry Digest, p 143, Mar 1971.

Descriptors: *Farm wastes, *Dehydration, *Costs, Poultry, Equipment, Fertilizers, *Waste treatment. Identifiers: Shelf life.

Conventional dehydrating equipment is available for drying poultry manure. However, the cost of the processed manure is likely to exceed \$20 per ton. A two-stage drying process has been developed that brings the cost down to \$7.60 per ton for a product with 10% moisture. The final product is a fine powder, free of offensive odors, has shelf life and it has the qualities required for sale as an organic fer-tilizer. It contains 4 to 5% nitrogen, 3% phosphoric acid, and 2.5% potash. (Christenbury-Iowa State)

HOW CAN PORK PRODUCERS COMPLY WITH ENVIRONMENTAL QUALITY STAN-DARDS.

lowa State Univ., Ames. Dept. of Agricultural Engineering.
J. Ronald Miner.

American Pork Congress-Proceedings, Environmental Quality Workshop, Des Moines, Iowa, Mar 3, 1971. p 98-102.

Descriptors: *Farm wastes, *Hogs, *Environment, *Pollution abatement, Water quality, Standards, Water pollution, Air pollution, Odor, Confinement pens, Organic matter, Nutrients, Nitrogen, Phosphorus, Eutrophication, Algae, Pathogenic bacteria, Effluent, Irrigation, Storage, Waste

Identifiers: *Environmental quality, Air contaminant, Stream quality, Waste management, Manure collection, Manure transport.

To prevent water and air pollution while maintaining environmental quality is a complex problem. It becomes more complicated by trying to design waste management systems which contribute materially to our effectiveness as pork producers with pollution control as a side benefit. A swine manure management system might include a collection device, a manure transport system, some means of manure storage and/or treatment, and finally, a manure or effluent disposal system. In some cases more than one of these components may be included in a single component. Giving initial consideration to the disposal scheme will help determine decisions to be made concerning the other aspects of the system. There is much remaining to be learned relative to the control and measurement of odors. Various odor levels can be

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achieved by the judicious selection of manure handling techniques. (White-Iowa State) W71-08214

DEHYDRATION OF ANIMAL WASTES,

Agricultural Research Service, Columbia, Mo. Transportation and Facilities Research Div.

Herman F. Mayes.

Paper presented at the 1971 Mid-Central Meeting
American Society of Agricultural Engineers, Paper
No MC-71-805. 15 p, 2 fig, 4 ref.

Descriptors: *Farm wastes, *Fertilizers, *Dehydration, Disposal, Livestock, Economics, Marketing, Economic feasibility, Operating, Storage, Operating costs, Operation and maintenance, Costs, Waste treatment.
Identifiers: Dehydrator design.

Four large terminal livestock markets have been dehydrating cattle and sheep manure since the early 1950's. The dehydrated manure is being merchandised as a specialty fertilizer. The design features of these dehydrators, the operating problems and some typical operating costs are reviewed. These markets have shown that animal wastes can be dehydrated and marketed. While a profit may not have been realized from the sale of this dehydrated manure, it may have been the cheapest method of disposal. (Christenbury-lowa State) W71-08216

A MODEL STUDY TO DETERMINE THE EF-FECTS OF VENTILATION SYSTEMS UPON NH3 CONCENTRATIONS IN SWINE CONFINE-

MENT HOUSING,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering; and Nebraska Univ., Lincoln. Dept.

C. N. Ifeadi, and J. A. DeShazer.
Paper presented 1971 Mid-Central Meeting American Society of Agricultural Engineers, Paper No MC-71-103. 9 p, 1 fig, 1 tab, 2 ref.

Descriptors: *Model studies, *Odors, *Ventilation, *Ammonia, Laboratory tests, Physical models, Structural models, Hogs, Air circulation, Statistical models, Farm wastes, Waste water treatment.
Identifiers: Slotted floors, Airflow rates, Inlet

systems, Exhaust systems.

A plexiglass model 1/12 the size of an existing swine building was used to determine the effect of various ventilation systems upon the NH3 concentration in the model. From this investigation, it was found that as more air exhausted below the floor the concentration of NH3 above the floor decreased. Also the inlet settings influenced the concentration of NH3 above the floor. (Christenbury-Iowa State) W71-08217

ANAEROBIC LAGOONS: CONSIDERATIONS IN DESIGN AND APPLICATION,

Cornell Univ., Ithaca, N.Y

Raymond C. Loehr.

Transactions of the American Society of Agricultural Engineers, Vol 11, p 320-322 and 330, 1968. 2 fig, 4 tab, 14 ref.

Descriptors: *Farm lagoons, *Anaerobic digestion, *Design, *Solids, Anaerobic conditions, Farm wastes, Temperature, Gases, Biochemical oxygen demand, Waste water treatment.

Identifiers: *Solids removal, Loading, Gas production, effluent quality.

Design and application of anaerobic lagoons for treatment of wastes from farm animals in confinement is described. The purpose for anaerobic lagoons is given in relation to aerobic lagoons and other treatment systems. The article proceeds to discuss size requirements, loading restrictions and mixing, both natural and mechanical as required. Quantities and quality of gas production are discussed as well as temperature relationships to gas production and other operating conditions. A short analysis of effluent quality is presented. Solids removal is discussed in some length. The article concludes by mentioning some difficulties such as potent effluent, warm temperature requirements and odors due to biochemical imbalance. (Parker-Iowa State) W71-08220

MANURE LAGOONS.....DESIGN CRITERIA AND MANAGEMENT, Maryland Univ., College Park. Dept. of Agricul-

tural Engineering. Harry J. Eby.

ASAE Paper No 61-935. Agricultural Engineering Journal, Vol 43, p 698-701, 714-715, Dec 1962. 6 fig, 1 tab, 19 ref.

Descriptors: *Farm lagoons, *Design criteria, Water temperature, Sewage treatment, Aerobic bacteria, Aquatic plants, Anaerobic bacteria, Algae, Biochemical oxygen demand, Oxidation lagoons, Sludge, Photosynthetic oxygen, Farm wastes, Waste water treatment. Identifiers: *Site selection, Loading.

Criteria to be considered when designing a lagoon for treatment of wastes produced by animals in confinement is discussed. It mentions situations where lagoons would not be feasible. Seven criteria for site selection are given. The physical, chemical and biological factors discussed include temperature, light, specific gravity, mixing, nutritional effects, pH effects, toxic effects, and interrelationship of biological species. Also mentioned is the algal-bacterial relationship. Design factors for size and volume are given. The article concludes with management problems encountered such as floating debris, overloading, intermittent loading, aquatic weeds and sludge build-up. (Parker-lowa State) W71-08221

NITRATE REMOVAL FROM AGRICULTURAL

WASTE WATER, Federal Water Pollution Control Administration, Fresno, Calif.; and California Dept. of Water Resources, Fresno.

Percy P. St. Amant, and Louis A. Beck.
In: Water Quality Management Problems in Arid Regions, Water Pollution Control Research Series, 13030 DYY, 6/69, Oct 1970, USDI, Federal Water Quality Administration, p 1-8. 1 tab, 1 fig.

Descriptors: *Return flow, *Nitrates, Water pollution, Desalination, Algae, Denitrification, California, Californi nia, Filters, Particle size, Anaerobic conditions, Waste water treatment.

Identifiers: *Nitrate removal, Algae stripping, Pond denitrification, Filter denitrification, Methanol, Bacterial denitrification, San Joaquin Valley.

The problem of disposing of irrigation waste water from the San Joaquin Valley of California is a very large one. The most serious potential pollutant is nitrogen in the nitrate form. A waste water treatment center at Firebaugh, California has organized and is carrying out research in the areas of desalination, algae stripping, and bacterial denitrification. Algae stripping simply involves growing a crop of algae to remove nitrogen from the water, and then harvesting the algae. Various markets have been proposed for the use of algae. Two methods of bacterial denitrification being explored are pond denitrification, and filter denitrifieation. The three denitrification methods are compared as to land requirements and project costs. Each is nearly the same in cost - around \$10 per acre foot, however the algae stripping method requires much more land. (See also W71-06111) (White-Iowa State)

WATER QUALITY REQUIREMENTS AND RE-USE OF WASTE WATER EFFLUENTS, Federal Water Pollution Control Administration, Washington, D.C.

Stanley J. Dea.

In: Water Quality Management Problems in Arid Regions, Water Pollution Control Research Series, 13030 DYY, 6/69, Oct 1970, USDI, Federal Water Quality Administration, p 37-44. 1 tab.

Descriptors: *Water quality, *Waste water treat-ment, *Water reuse, Effluent, Waste water, Water Quality Act, Beneficial use, Water supply, Biological treatment, Sewage effluents, Filters, Activated sludge, Tertiary treatment. Identifiers: *Nutrient removal.

From the overall view of potential water supply shortages in the United States, advanced waste treatment has the greatest promise at locations where the municipal waste water is presently discharged into the ocean or other sinks, and is lost for reuse. An advanced waste treatment facility for turning waste discharges into potable water is described for New York City. The most urgent needs in sewage treatment technology include modifications of 'conventional' processes and advanced or tertiary treatment. Advanced treatment for the removal of nutrients, organics, and inorganics can be accomplished for about 26-30 cents/1000 gallons compared to 11 cents/1000 gallons for secondary treatment. However, the reclaimed waste water from advanced treatment has economic utility and value for reuse. (See also W71-06111) (White-Iowa State) W71-08224

DISTILLATION OF WASTE WATERS: A WATER RESOURCE FOR ARID REGIONS,

Federal Water Pollution Control Administration, Washington, D.C. Office of Research and Develop-

Allen Cywin, George Rey, Stanley Dea, and Harold

In: Water Quality Management Problems in Arid Regions, Water Pollution Control Research Series, 13030 DYY, 6/69, Oct 1970, USDI, Federal Water Quality Administration, p 85-94. 14 ref, 2 fig, 1 tab.

Descriptors: *Distillation, *Waste water treatment, Effluent, Potable water, Water reuse, Water quality, Brackish water, Sewage treatment, Costs, Waste dilution, Demineralization, Water resources.

Identifiers: *Blowdown ratio, Salt removal, Mineral content, Total dissolved solids.

The authors propose distillation of municipal waste water for the production of low mineral content water for industrial purposes, particularly for those industries which require such water in large quantities. Distillation has previously been limited in arid regions to applications using saline waters as a feedwater supply. The use of waste water may very possibly result in less costly distilled water. A part of the waste water renovation costs can be at-tributed to pollution control. Dilution of tertiarytreated effluents with a lower mineral content municipal water can also produce a product water of acceptable mineral content. The lower concentrations of sulfate and total dissolved solids in waste water effluents is also advantageous. Total treatment costs for the processes involved are given. (See also W71-06111) (White-Iowa State) W71-08227

STORM SEWER SYSTEMS,

American Public Works Association, Chicago, Ill. Research Foundation.

Herbert G. Poertner.

In: Public Facility Needs, Washington, DC, 1966, p

Descriptors: *Sewers, *Runoff, *Waste water, *Investment, *Economic analysis, *Drainage, Canals, Precipitation floods, Pollution, Capital, Costs, Benefits, Financing. Identifiers: User charges, Ownership, Urban

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A description is presented of the nature and composition of storm sewer systems, their functions, and the fundamental principles involved. The services rendered by such systems, particularly avoidance of economic loss from flooding and inadequate runoff, is cited, along with dangers and damages that can exist. Both quantitative and qualitative standards of performance and design are discussed. A brief history of storm sewers is in-corporated into a discussion of existing capital plant of the sewers and capital investment in urban drainage improvements is presented by both re-gional and state breakdowns, indicating both sewer system age and ownerships. Costs, charges, and benefits of the sewer system present the economic basis for the systems, and trends of capital outlay are presented according to expenditures and sources of financing. Estimated capital requirements present a projection for needs and prospective capital outlays in the storm sewer systems and indicate the major sources to be tapped for such financing. (See also W71-08281) (Murphy-Rutgers) W71-08285

SANITARY SEWER COLLECTION SYSTEMS,

Department of Housing and Urban Development, Washington, D.C.

In: Public Facility Needs, Washington, DC, 1966, p 137-151.

Descriptors: *Economic evaluation, *Waste disposal, *Sewers, Capital financing, Costs, Economics of scale, Drainage, Streams, Rivers, Pollution, Groundwater.

Identifiers: *Economic development, User charges, Public service, Ownership patterns, Public health.

A comprehensive study is presented of sanitary sewer collection systems as the means of removing wastes. A brief history of the development of such systems is presented, which incorporates a discussion of pollution in addition to presenting various means of waste removal. The physical characteristics and the standards of performance of the sewer systems are precisely described, and the existing capital plant for such facilities is discussed. Particular attention is given to growth, distribution, and ownership patterns. Construction, operation and maintenance costs are juxtaposed with user charges, and trends in capital outlay are subdivided into annual outlays and sources of financing. Needs and prospective capital outlays for the future are presented, and estimated capital requirements are suggested, along with potential means of financing. The role of federal assistance in the future economic development of the sewer collection systems is also dealt with in some detail. (See also W71-08281) (Murphy-Rutgers) W71-08286

ELECTRIC POWER AND THERMAL DISCHARGES; THERMAL CONSIDERATIONS IN THE PRODUCTION OF ELECTRIC POWER. For primary bibliographic entry see Field 05B. W71-08298

THERMAL WASTE TREATMENT AND CON-

TROL, Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab. Frank H. Rainwater.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power, Gordon and Breach, New York, p 189-212,

Descriptors: *Thermal powerplants, *Cooling, *Cooling towers, Evaporation, Brackish water, Meteorology, Environmental effects, Thermal pollution, Economic feasibility, Waste water treatment

Identifiers: *Thermal waste treatment, Colling ponds, Cooling systems, Dry cooling towers, Spray

With today's technology the electric power industry can meet State-Federal water temperature standards. Four basic supplementary heat rejection units that are economically attractive at the present time, for large powerplants are described: natural draft towers, mechanical draft towers, open ponds and spray canals. Three alternative cooling systems are discussed: (1) open-cycle system, that may involve either once-through systems or open-cycle waste heat treatment systems incorporating one of the afore mentioned treatment units; (2) recycling systems with waste heat treatment facilities; and (3) combination systems for seasonal operation. It is predicted that spray-type condensers and dry towers of the Heller system will take their place with evaporative cooling systems as a practical and competitive alternative in the near future. (See also W71-08298) (Oleszkiewicz-Vanderbilt)

CONSIDERATIONS IN TRANSLATING EN-VIRONMENTAL CONCERN INTO POWER PLANT DESIGN AND OPERATION,

Duke Power Co., Engineering Department. William S. Lec.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 229-248,

Descriptors: *Thermal pollution, *Thermal power-plants, *Cooling water, *Design criteria, *Environmental effects, Heat, Mixing, Cooling towers, Waste water treatment.

Identifiers: *Heat dissipation, Dry cooling towers, Spray ponds.

To better translate our environmental concern into power plant design and operation, we must develop techniques for reliable ecological forecasting with which we can predict in advance the relative effects of alternative cooling methods. The types of cooling systems classified according to heat dissipation mechanisms are (a1) remote and gradual dissipation by mixing, (2) rapid dissipation locally using open water bodies, (3) rapid dissipation on site with cooling towers and spray ponds, and (4) seasonal shortage of heat in water bodies for later dissipation in cool weather. A drive toward improved cycle efficiencies, including breeders, to reduce heat rejection must be pressed harder. Monstrous in size, costs and in water losses, cooling towers should be critically considered from the viewpoint of alternative, innovative designs. Dry cooling towers should be considered as an alternative. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08309

POWER PLANT COOLING IN PERSPECTIVE,

Commonwealth Associates, Inc., Jackson, Mich. Architectural and Engineering Systems. A. C. Kelsall

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 249-268, 1971. 9 fig.

Descriptors: *Thermal pollution, *Thermal power-plants, *Cooling, *Cooling towers, *Ponds, *Pumped storage, *Peak power, Evaporation, Con-vection, Radiation, Heated waters, Thermodynamics. Waste water treatment.

Identifiers: Selective withdrawal, Spray ponds.

Following a general presentation of the second law of thermodynamics, the author discusses three means of heat dissipation that can be applied through the cooling facilities: evaporation, convection and radiation. Advantages of cooling ponds are discussed; the need for supplementary evaporative devices, such as spray ponds or cooling towers, is stressed. Assuming that some precooling of power plant water is required, an alternate to riverside cooling towers can be developed where there is room for an off-channel holding pond. A conventional intake structure is used to withdraw cool water from the river. The warm water discharged from the condensers is then pumped up to a holding reservoir on a 24-hour per day basis, to be released, after cooling off, during peak periods. The system constitutes a minature pumped storage installation. (See also W71-08298) (Oleszkiewicz-W71-08310

NATURAL BODIES OF WATER FOR COOL-ING.

Sargent and Lundy, Chicago, Ill. Tor D. Kolflat.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 295-349, 1971. 18 ref, 31 fig.

Descriptors: *Thermal pollution, *Thermal power-plants, *Heated water, *Cooling, *Heat balance, *Condensers, Evaporation, Convection, Radiation, Waste water treatment.

The electrical energy waste heat contribution of 6.3 x 10 to the 12th power BTU/day, estimated for the year 2000, represents about 0.07% of the annual average natural solar energy contribution of 205 x 10 to the 15th power BTU/day. After discussing the hydro-thermal effects of heat discharge to surface water, the author describes techniques to alter natural behavior of river water. In order to draw the coolest possible water from the river a skimmer wall is on occasion used, 'skimming' off the hot water floating on the top. Several plants discharge the warm water at the top of the river to accelerate dissipation of its heat to the air. When rapid mixing is required a diffuser pipe is used. Dilution within the condenser is obtained by the establishment of condenser design. Another arrangement is to select the optimum condenser rise independent of dilution considerations and dilute the water after it leaves the condenser. A 25F condenser rise may be reduced to 16F, 12F, or 8F by adding dilution water in the amount of 50%. 100% or 200% of the condenser flow respectively. (See also W71-08298) (Oleszkiewicz-Vanderbilt)

COOLING TOWERS FOR LARGE STEAM-ELECTRIC GENERATING UNITS, Black and Veatch, Kansas City, Mo.

Riley D. Woodson.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power, Gordon and Breach, New York, p 351-380. 1971. 6 fig, 5 tab.

Descriptors: *Thermal pollution, *Cooling towers, *Thermal powerplants, *Economic feasibility, *Capital costs, Cooling, *Condensers, Cooling water, Investment, Economic efficiency, Fuels, Nuclear powerplants, Environmental Waste water treatment.

Identifiers: *Dry cooling towers, *Wet cooling towers, Mechanical draft, Natural draft.

All feasible types of cooling towers have been considered and the cost of each type is illustrated for a typical 800 megawatt unit. Mechanical draft wet towers are the most economical type of cooling towers for nearly all applications. Although apparently feasible, dry type cooling towers are not economically competitive due to high investment costs and lower steam cycle efficiency due to high condenser pressures. Some may be installed under special circumstances. Sophisticated design and optimization of both cooling tower and cooling systems are being done and will continue to develop, including direct digital control management of cooling tower operation. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08314

Water Quality Control—Group 5G

5E. Ultimate Disposal of Wastes

CINDER CONE SEWAGE DISPOSAL AT NORTH LAKE TAHOE, CALIFORNIA, California Div. of Mines and Geology, Sacramento. Robert A. Matthews, and Alvin L. Franks. Water and Sewage Works, Vol 118, No 1, p 2-5,

Descriptors: *Sewage disposal, *Effluent, *Percolation, Seismic studies, Fractures (Geology), Drainage, Infiltration, Monitoring, Flow rate, Permeability, California, Waste disposal. Identifiers: Lake Tahoe (Calif), Truckee River

As a result of extensive field investigations and evaluations 'Cinder cone' was selected as sewage disposal area to handle 20 mgd of sewage. Seismic refractions gave indications of rock formations and that the effluent will flow towards the Truckee River drainage to the west. Four drill holes were made and carefully studied by bore hole television cameras. Results of the drilling and water testing of these holes indicated that the subsurface would accept the effluent 1500 ft of trenches were made in the area and graphed into 4 groups. Percolation rates of group 1 was 620 gpm after 30 hours and decreased to 300 gpm after 200 hours. Group 2 a similar material to group 1 has a percolation rate of 250 gpm after 200 hours. This decreased rate is due to shorter trench length rather than variation of material. Tests indicate that percolation rate in group 3 and 4 may be too rapid to provide filtration and treatment. Data from spring No. 8 showed an increase in chloride with increase in coliform count. No change of the quality of water of the other sampling areas was detected. (Rayaan-Texas) W71-07771

TECHNIQUES OF DEEP WELL DISPOSAL-A SAFE AND EFFICIENT METHOD OF POLLU-TION CONTROL; American Industrial Disposal System Inc., Pitt-

sburgh, Pa.

For primary bibliographic entry sec Field 05G. W71-08015

INCINERATION OF PROCESS INDUSTRY

Trecan Ltd., Cooksville (Ontario). For primary bibliographic entry see Field 05G. W71-08016

ECONOMICS OF **ALTERNATIVE** METHODS OF WHEY DISPOSAL AT SOUTHERN ONTARIO CHEESE FACTORIES, Ontario Dept. of Agriculture and Food, Toronto. For primary bibliographic entry see Field 05G.

DISPOSAL OF RADIOACTIVE WASTE FROM

WINDSCALE, Ministry of Agriculture, Fisheries and Food, Lowestaft (England). Fisheries Radiobiological

For primary bibliographic entry see Field 05G. W71-08161

5F. Water Treatment and **Quality Alteration**

ISOLATION OF POLIOVIRUS FROM DRINK-ING WATER.

Michigan State Univ., East Lansing. Dept. of

Microbiology.
Walter N. Mack, and Donald B. Coohon. Michigan Agricultural Experiment Station Journal Article No 5276, nd (1970). 7 p, 1 tab, 3 ref. OWRR Project A-026-MICH (1). Descriptors: *Water treatment, *Public health, *Viruses, Diseases, Water pollution control, Centrifugation, Isolation, Separation techniques, Chlorination, Disinfection, Coliforms, Bacteria, Waste water treatment.
Identifiers: *Poliovirus, Hepatitis, Gastroenteritis.

Evidence has accumulated to suggest that viruses Evidence has accumulated to suggest that viruses can be transmitted in drinking water, but no concrete isolations had been made. Multiple cases of illness in the patrons of a southeastern Michigan restaurant, having a private well, initiated a complete epidemiological investigation of the well water. Coliform organisms were found in 2 of 5 samples of the water over a 12 month period, indicating the presence of some fecal contamination. samples of the water over a 12 month period, indicating the presence of some fecal contamination. Neither Shigella nor Salmonella organisms were isolated from the water, so further isolation techniques were used specifically to detect whether or not there were viruses present in the water. 5 gallons of well water were obtained from the well, with approximately half being treated with 60 ppm of polyethylene flocculant. Subsequent concentration and centrifugation techniques were successful and an agent was recovered which produced extensible effect on Green African monkey kidney cytopathic effect on Green African monkey kidney cultures. A second initial recovery was also successful, and the agent was subsequently identified by standard laboratory procedures as type II poliovirus. This is believed to be the first isolation of an enterovirus from drinking water in the United States. (Lowry-Texas)
W71-07765

QUALITY VERSUS RESIDUAL CHLORINE, Public Health Service, Cincinnati, Ohio. Control

Technology Branch.
W. Ralph Buclow.
Journal American Water Works Association, Vol 63, No 1, Jan 1971. 10 fig, 3 tab, 9 ref.

Descriptors: *Chlorine, *Coliform, *Water distribution systems, Turbidity, Clarification, Groundwaters, Surface waters, Springs, *Water treatment.

This paper deals with how much, what level of, and the proper surviellance of chlorine residual. A review of some literature which shows the influence of chlorine residual on bacteriological quality in distribution systems as well as the sampling practice in Europe is presented. Chlorine residual in 1966-1967 in Cincinnati, Ohio was maintained at .85 plus or minus .2 mg/l. But in 1969-1970 this was increased to 2 mg/l with 80% as free chlorine. Tabulated results for this period show no appreciable variation in the bacteriological quality of the water and it shows that a change from combined to free chlorine residual and increase in residual concentration reduced the monthly average coliform counts. Study of the bacteriological quality of the distributed water by the use of various systems as related to chlorine prac-tice is presented with supporting figures and tables. It is concluded from that study that surface, spring and raw well water sources need to be chlorinated if coliform was detected in the distribution system and not detected in the raw water. A presentation of this sample procedure and findings for the Cincinnati water system with illustrative drawings and tables is included. The data collected from that system support the suggestion that the bacteriologi-cal samples should be collected from known problem areas in reservoirs, dead ends and the periphery of the system. (Rayaan-Texas) W71-07768

OF SEASONAL EFFECT CHLORINATION ON COLIFORMS IN JAMA-

ICA BAY, R. T. Dewling, I. Seidenberg, and J. Kingery. J Water Pollution Control Fed, Vol 42, No 7, p 1361, Jul 1970.

Descriptors: Investigations, *Chlorination, Effluents, Water pollution sources, Water quality, Data collections, Coliforms, Analytical techniques, *Overflow, *Discharge measurement, Public Health, Water treatment.

Identifiers: *Jamaica Bay (NY), *Storm overflows, Combined sewers.

This article is a report on a study conducted to demonstrate that chlorination of waste water treatment plant effluents would significantly improve the bacteriological quality of Jamaica Bay. A description of the investigation procedure, the Bay area, and its water uses and pollutants is given; water quality data collection analysis is detailed. The average daily discharge from storm and combined sewer overflows was calculated at about 34 million gallons based on a storm occurring at a frequency of about once every three days. W71-07873

THE BACTERICIDAL EFFECT OF LIME FLOCCULATION/FLOTATION AS A PRIMARY UNIT PROCESS IN A MULTIPLE SYSTEM FOR THE ADVANCED PURIFICATION OF SEWAGE WORKS EFFLUENT, National Inst. for Water Research, Pretoria (South

For primary bibliographic entry see Field 05D. W71-07992

THE VIROLOGY OF WASTE WATER TREAT-

MENT, National Inst. for Water Research, Pretoria (South For primary bibliographic entry see Field 05D. W71-07993

A PRELIMINARY 'LEAST COST' STUDY OF FUTURE GROUNDWATER DEVELOPMENT IN NORTHEASTERN ILLINOIS, Illinois State Water Survey, Urbana, Ill. For primary bibliographic entry see Field 04B. W71-08123

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 04B. W71-08129

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE. VOLUME 1, SUMMARY SUP-

Fresno County Planning Dept., Calif. For primary bibliographic entry see Field 06B. W71-08178

5G. Water Quality Control

WATER POLLUTION, For primary bibliographic entry see Field 06E. W7 1-07709

WATER CLASSIFICATION STANDARDS SYSTEM FOR THE STATE OF SOUTH CAROLINA.

South Carolina Pollution Control Authority,

For primary bibliographic entry see Field 06E.

ENVIRONMENT,

For primary bibliographic entry see Field 06E. W71-07715

SHIP INTERN PROGRAMS--QUALIFIED DEGREES.

For primary bibliographic entry see Field 06E. W71-07716

MARINE POLLUTION PROBLEMS AND REMEDIES,

For primary bibliographic entry see Field 06E.

Group 5G—Water Quality Control

W71-07717

NATIONAL WATER QUALITY STANDARDS ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL

For primary bibliographic entry see Field 06E. W71-07718

SANTA BARBARA CHANNEL MORATORIUM AND ECOLOGICAL PRESERVE ACT (A BILL TO PROVIDE FOR A FEDERAL ECOLOGICAL PRESERVE IN A PORTION OF THE OUTER CONTINENTAL SHELF).

For primary bibliographic entry see Field 06E. W71-07719

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO PROTECT THE NAVIGABLE WATERS OF THE UNITED STATES FROM FURTHER POLLUTION BY REQUIRING THAT PESTICIDES COMPLY WITH CERTAIN STANDARDS OF BIODEGRADABILITY AND TOXICITY. For primary bibliographic entry see Field 06E.

CONSUMER ASSESSMENT OF WATER QUALITY AND THE COST OF IMPROVE-MENTS.

California Univ., Berkeley. School of Public

W. H. Bruvold, and P. C. Ward.

Journal American Water Works Association, Vol 63, p 3-5, Jan 1971. 3 tab, 4 ref.

Descriptors: *Water quality, *Costs, Utilities, Water rates, Surveys, Evaluation, Domestic water. Identifiers: *Consumer assessment, *Interview schedule, Improvements, Complaints.

This paper illustrates how a consumer survey could be used to document the nature and extent of water quality problems and how information could be obtained from consumers regarding their willingness to pay for improvements in quality. Further, the use of such surveys to deal with four general issues involved in improving water quality was discussed. The interview schedule was presented. The final instrument was divided into two main parts: one dealing with consumer assessment of water quality and the other with the cost of the local water, the possible need for improving water quality, and the cost of such improvements. Tabulated data included structure ratings for water in general and taste, reasonable and highest increase, and water rates. (Wang-Rutgers) W71-07738

BOARD OF PURIFICATION OF WATERS V TOWN OF EAST PROVIDENCE (STATE POWER TO REQUIRE CITY TO ABATE POL-LUTION OF RIVER).

For primary bibliographic entry see Field 06E. W71-07741

CITY OF NORWOOD V SHEEN (DAMAGES FOR SEWAGE FLOW ON PRIVATE PROPER-TY).

For primary bibliographic entry see Field 06E.

SEWER AND ENVIRONMENTAL ASPECTS OF WATER QUALITY STANDARDS,

Munchito Kuribayashi. Kogai to Taisaku, Vol 6, No 8, p 631-634, Aug 15,

Descriptors: *Sewers, *Design, *Treatment facilities, *Waste water treatment, Water quality, *Standards, Drainage, Sewerage. Identifiers: Japan.

Improvements of existing drainage systems and ex-tensive development of drainage works are required on the present sewer systems in order to comply with new water quality standards. Large-scale sewerage works, planned on a basin area unit system, have more advantages because of the mix-ture of treated wastes produced. Advanced system engineering dealing with dynamic programming and multi-level-techniques will be employed in this sewer scheme which eventually may decide general water quality. W71-07848

WATER QUALITY STANDARD OF THE RIVER KANO,

Yoji Ogawa

Kogai to Taosaku, Vol 6, No 7, p 541-549, Jul 15,

Descriptors: *Water pollution sources, *Water quality control, *Standards, *Water pollution control, Urbanization.

Identifiers: *Japan, *Kano River Basin.

The Kano River Basin supports fresh water fish and the water is used for irrigation purposes. Industrial development and urban growth in the vicinity of the river basin have contributed to the water pollution problem. The Economic Planning Agency which investigated the quality of the basin water in the years 1966 and 1967 designated the water area and the water quality standard so as to maintain water quality control. By the year 1975, the pollution degree is estimated to decrease approximately 60% with water pollution control based on the new standard. W71-07851

TECHNOLOGY: TEST COMBINED SEWER TREATMENT.

Modern Power Eng, Vol 64, No 8, p 33, Aug 1970.

Descriptors: *Sewers, *Sewage treatment, *Treatment facilities, Overflow, Water pollution control. Identifiers: *Combined sewers, *Storm sewers, *Storm overflows, Racine (Wis).

Racine, Wisconsin is the test area for a system of satellite sewage treatment plants designed to eliminate the need for separating storm and sanitary sewers. The process involves five satellite plants which will treat the discharge from the combined sewer overflow during periods of heavy runoff. A screen/dissolved air flotation unit will remove inorganic pollutants and suspended solids from the combined sewer overflow. W71-07852

CLEVELAND FACES POLLUTION SUIT.

Chemical Week, Vol 107, No 9, p 18, Aug 26,

Descriptors: *Legal aspects, *Water pollution sources, Water pollution control, Lake Erie, Treatment facilities, City planning, Contracts, Ohio, Sewers, *Chlorination.

Identifiers: *Cleveland (Ohio), *Interceptor

The Ohio Water Pollution Control Board has directed Attorney General Paul Brown to file suit against Cleveland for failure in meeting a June 15, 1970 deadline to install temporary chlorination facilities in its sewage treatment plants which pollute Lake Erie. The city also failed to meet a July 1st deadline to contract for sanitary interceptor sewer plans in various parts of the city. W71-07853

GRID FOR RETAINING LARGE COM-PONENTS OF SEWAGE IN SEWAGE PUMPING

EOUIPMENT.

Netherlands Patents .. NL 6817241.

Descriptors: *Patents, *Sewage. Identifiers: *Pumping equipment, *Retaining grid.

The grid is designed for insertion in a pipeline and for cleaning by backwashing. It is fabricated from a series of initially parallel plates bonded to the pipe wall at the edges. The dimensions are such that their axial length is at least 8 times the interplate

CATCHBASINS CLEANED FOR \$3.00.

Public Works, Vol 101, No 8, p 81, Aug 1970. 2

Descriptors: *Cleaning, Maintenance, Cost comparisons, New Jersey, Water pollution control, *Costs.

Identifiers: *Suction machine, *Teaneck (NJ).

Teaneck, New Jersey's switch from bucket cleaning of catchbasins to suction cleaning with a Good Roads Scavenger has reduced costs of the twice-a-year job by 80%. The rate of catchbasin cleaning has also increased considerably. The suction machine is also used to clean out manholes, to clean streets, and to pickup and dispose of leaves on streets and park grounds during autumn.

'BEEHIVES' PROTECT SNOW-REMOV SALT AND PREVENT WATER POLLUTION, John R. Fitzpatrick. SNOW-REMOVAL

Am City, Vol 85, No 9, p 81-83, Sept 1970.

Descriptors: *Control structures, *Structures, *Construction, *Structural design, Water pollution Identifiers: *Canada.

Salt-sand piles, used as storage for a road clearing mixture during winter months in Ontario and sub-ject to leaching by rain, will be covered so as to les-sen this potential source of contamination. This article discusses the construction materials, the design dimensions, and the methods of erection for the 20 sided, cone-shaped storage structure. W71-07859

RENEWAL IS VALID TERM IN BOSTON.

Public Works, Vol 101, No 7, p 70-71, Jul 1970.

Descriptors: *Separation techniques, *Sewerage, *Storm drains, Construction materials, Urban

Identifiers: *Boston (MASS), *Sanitary sewers.

As part of the Bay Village urban renewal project in Boston, the old sanitary and storm drain system was replaced with separate systems. Asbestos-cement pipes were used for the first time in Boston for the sanitary sewer. Reinforced concrete was used for the new storm drain, which parallels the sanitary sewer. Other public improvements in this area include resurfacing of streets, renewal of un-derground facilities, and installation of brick sidewalks and gas lamps. W71-07860

SEWERAGE PRACTICES IN THE GULF COAST AREA,

John K. Mayer, Frank W. MacDonald, and Stephen E. Steimle.

Public Works, Vol 101, No 8, p 71-72, Aug 1970. Descriptors: *Sewers, *Surveys, *City planning,

Construction materials, Pipelines, Infiltration, Water table, Average flow.
Identifiers: *Sanitary sewers, *Gulf Coast, Treatment methods.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

For the purpose of obtaining background informa-tion on sanitary sewers in the Gulf Coast areas, 71 municipalities and sewer districts spanning the coast from Texas through Florida were canvassed by questionnaire during the latter part of 1967 and the early part of 1968. The article describes the following results obtained from the survey: (1) type of sewers, (2) length of sewers, (3) pipe construction materials, (4) type of bedding used, (5) infiltration experience, (6) soil description and depth of water table, and (7) average flow and treatment used.

STORM SEWER ASSESSMENTS,

Richard R. Dague. Public Works, Vol 101, No 8, p 62-66, 118, Aug 1970. 2 fig, 2 ref.

Descriptors: *Cost-benefit analysis, *Assessments, Runoff coefficient, Rainfall intensity, Drainage dis-

Identifiers: *Des Moines (Iowa), *Storm sewers.

The author presents a method of storm sewer assessment which was applied to a project in Des Moines, Iowa. Four benefit factors considered in apportioning property costs can be utilized in storm sewer assessment if the relative weight of each fac-tor is determined by the relative benefit to be accrued. Other factors to be considered reflecting costs and therefore benefit are: (1) the area drained, (2) the runoff coefficient, (3) the rainfall intensity, (4) the distance to the outlet, (5) the unit pipe cost, and (6) the slope of the sewer. Each of these factors are discussed in relation to a sub-area. Once the dollar benefit to each sub-area is determined, the benefit to individual properties within sub-areas must be ascertained. Also, in arriving at storm sewer assessment, the benefit accruing to public property must be considered. Means for evaluating all of these factors are thoroughly described. The Des Moines procedure outlined in this article does not necessarily have application to all storm sewer special assessment problems. The test of the method will come through its application to a variety of storm sewer assessment problems along with success in the courts.

W71-07863

STORM SEWER DESIGN,

F. D. Rickman.

Paper presented at the National Conference Committee on Electronics, American Association of State Highway Officials, Austin, Texas, May 7-8,

Descriptors: Computers, *Computer programs, Design, *Design criteria, Sewers, Water pollution

Identifiers: *Storm sewers, *Storm sewer design.

The Fortran program was developed to design storm sewers from the basic data of rainfall, drainage areas, and pipe slopes and lengths. Storm sewer design lends itself to a computer operation because of the repetitive calculations involved in designing a complicated system of interconnected pipes. A program has been written in Fortran II for the IBM 1620 computer; a program for output list-ing was written for the IBM 1401 computer to give a better presentation to the designer and engineer. The storm sewer program is now being converted from Fortran II to Fortran IV.

RATIONAL 'RATIONAL' METHOD OF STORM DRAINAGE DESIGN (DISCUSSION).

Richard A. Rogers.
J Irrigation Drainage Div, Am Soc Civil Engrs, Vol
96, No IR3, p 342-343, Sept 1970.

Descriptors: *Storm drains, *Flow rates, Computer programs, Methodology, Drainage systems, Design.

The writer, discussing his original paper with the same title, has thus far been unable to comprehend, for the extreme case of a submerged storm system

and assumed incompressible water, how the rate of flow out of the system at the outfall can differ from the rate of inflow at the inlets at any time. A lag time has been introduced into the computer program to allow for utilization of storage available within the system. The writer agrees with the thought that the design flows at individual points may be found from intensities occurring when peak flows reach the points, but he disagrees with the thought that the design for flows between the points can be made for the same hydraulic grade at different times. W71-07865

\$37 BILLION: NEW PRICE TAG FOR CITIES' WATER POLLUTION CONTROL COSTS. Nation's Cities, Vol 8, No 8, p 8-9, Aug 1970.

Descriptors: *Estimated costs, Cost allocation, Cost analysis, *Cost comparisons, Cost sharing, *Costs, Cost trends, *Cities, City planning, *Sewers, Water resources development, Legislation, Treatment facilities, Storm runoff, Overflow, Separation techniques, *Storm sewers, Water pol-

The National League of Cities (NLC) and the United States Conference of Mayors (USCM) estimated between \$33 billion and \$37 billion will be nated between \$33 billion and \$37 billion will be needed to combat water pollution between 1970 and 1976, as reported by Senator Muskie, in comparison with FWQA reports of \$10 billion over the five year span, 1970-1974. The NLC-USCM survey asked for specific cost data categorized in the following manner: (1) needs for primary and secondary treatment facilities; (2) needs for tertiary treatment facilities; and (3) needs for interceptor and storm sewers, including projected costs of separating storm and sanitary sewers, and/or storing storm water overflows. The survey covered 1,008 communities with a combined population of approximately 89.4 million. Based on the projection from this survey, the NLC and USCM estimated the total national needs for state and local water pollution control facilities for the next six years which includes a five percent inflation factor. Discussion on past, present, and future legislative action is in-cluded, and a cost chart based on survey results is given. W71-07867

STORM DRAINAGE FACILITIES, UNION COUNTY, NEW JERSEY.

Union County Planning Board, N.J.

May 1970, 97 p.

Descriptors: *Floods, New Jersey, *Drainage, Storms, Design, Storage, Flow, *Storm drains, Water pollution control.

Identifiers: *Union County (NJ), *Storm sewers.

The report presents an inventory and analysis of the storm drainage facilities of Union County, New Jersey. Points of analysis were generally selected where streams cross major County throughfares. The tributary area to each of these points was determined. Estimates of minimum design flows were prepared. These suggested minimum design flows were then used to determine the adequacy of the existing drainage facility at the point of analy-

W71-07868

STORM DRAINAGE: INVENTORY AND ANAL-YSIS OF MAJOR EXISTING AND PLANNED FACILITIES: VOLUME V.

Valley Regional Planning Agency, Ansonia, Conn.

Feb 1970, 38 p.

Descriptors: *Planning, *Connecticut, *Sewers, *Drainage, Floods, Sewage, *Storm drains, Water pollution control.

Identifiers: *Urban planning, Urban drainage.

The fifth of a five-volume report that is being utilized as part of the basis for an areawide water/sewer plan and program for the Valley Region is detailed herein. This volume includes an inventory and evaluation of the major existing and planned facilities. The inventory includes a delineation of present areas served by storm sewers and areas requiring flood protection. (See also W71-07869)
W71-07870

POLLUTION STINK FOULS CITY HALL.

K. W. Bennett.

Iron Age, Vol 206, No 7, p 73-75, Aug 13, 1970.

Descriptors: *Legislation, Water pollution control, Water quality control, Industries, *Cities, *Pollution abatement, Legal aspects. Identifiers: *Law enforcement.

Although legislation has been passed concerning water pollution control in relation to industries and municipalities, enforcement of these laws has been directed more towards industrial control. However, the number of states taking action against cities which are pollution violators is on the rise. The author views the economic plight which the city faces and gives some examples of pollution abatement programs and treatment facilities under construction in cities across the United States. W71-07872

THE INTERACTIONS OF Cu.... AND CN- WITH PHYTOTOXICITY PARAQUAT TO

Oklahoma State Univ., Stillwater. Dept. of Agrono-

For primary bibliographic entry see Field 05C. W71-07881

AERATOR PERFORMANCE IN NATURAL STREAMS

Rutgers-The State Univ., New Brunswick, N.J. Water Resources Research Inst. Shaw L. Yu.

Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA5, p 1099-1114, Oct 1970. 8 fig, 2 tab, 12 ref, 2 append. OWRR Project B-022-NJ (5).

Descriptors: *Aeration, *Mechanical equipment, *Water treatment, Streams, Evaluation, Dissolved oxygen, Rivers, Oxygenation.

Identifiers: Aerator efficiency, Surface aerators, Diffuser aerators.

The oxygen transfer efficiency of a commercially available surface mechanical aerator and diffuser aerator was tested on Passaic River (New Jersey). Both types of aerators were found to be substantially less efficient in the natural stream than in tanks or lagoons. Average transfer rates of the mechanical and the diffuser aerators were 2.1 and 1.2 lb of oxygen per hp-hr, respectively. The efficiency of both aerators increased with a higher rate of river discharge. The estimates of the DO at the aerator corresponded to the average of upstream and downstream DO readings. In designing a river acration system it is essential to know the acrator's performance in the given stream. Examples illustrate conversions of specific standard transfer rates, commercially specified, to actual conditions. (Wilde-Wisconsin) W71-07885

ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS, Virginia Polytechnic Inst., Blacksburg, Dept. of Chemistry.

For primary bibliographic entry see Field 05D. W71-07910

Group 5G—Water Quality Control

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL I, SECTION A SUMMARY, Wisconsin Univ., Madison. Water Resources

Center.

Elizabeth L. David, Peter N. Davis, Irving K. Fox,
Anthony H. J. Dorsey, and Charles H. Faulkner.

Available from the National Technical Information
Service as PB-199 268, \$3.00 in paper copy, \$0.95
in microfiche. Technical Report, 1971. 165 p, 12
fig, 7 tab, 24 ref. OWRR Project C-1228-Wis (8).

*Watershed management, quality, *Wisconsin, *Evaluation, *Optimum development plans, *Cost-benefit analysis, Administration, Appraisals, Administrative agencies, Coordination, Feasibility studies, Financial feasibility, Institutions, Methodology, Regional analysis, Applies.

Identifiers: *Wisconsin River Basin (Wis).

A case study was made to determine least-cost systems for achieving specific water quality levels of the Wisconsin River Basin (Wisconsin). To inof the Wisconsin River Basin (Wisconsin). To in-titate least-cost systems, institutional prerequisites were analyzed and alternative institutional struc-tures considered. By application of a predictive water quality model based on dissolved oxygen and analysis of costs influencing DO levels, costs of systems to meet specified objectives are deter-mined indicating that substantial economics can be realized by utilization of a regional management system. Alternative policies and organizational arrangements are assessed. Potential and equitable economics could be realized with substantial changes in policy framework; an effluent-charge system would prove unnecessarily costly and its administration difficult; effective results can be achieved by a combination of regulation and cost sharing of system management by waste producers. Criteria of organizational design are established and applied to three alternative organizational arrangements. An organizational system including a quasi-judicial body (to establish standards), a state water resources agency (to monitor environmental interests), and a regional implementing and operatinterests), and a regional implementing and operating agency would most effectively meet the desired criteria. (See also W71-05040 and W71-05383) (Auen-Wisconsin)

COMBINED SEWER OVERFLOW SEMINAR

Federal Water Pollution Control Administration, Washington, D.C. Div. of Applied Science and Technology.

Available from the National Technical Information Service as PB-199 361, \$3.00 in paper copy, \$0.95 in microfiche. Papers presented at Seminar at Hudson-Delaware Basins Office, Edison, NJ, Nov 4-5, 1969, Water Pollution Control Research Series DAST-37, Mar 1970. 199 p. EPA Program 11020-

Descriptors: *Waste water treatment, *Storms, Run-off, Disinfection, Coliforms, Flotation, Flocculation, Coagulation, Screens, Hydrographs, Head loss, Pressure, Economic feasibility, Technical feasibility, Cost analysis, Maintenance, Labor. Identifiers: *Combined sewers, Segregated sewers.

A large number of cities still have combined sanitary and storm water sewers. During storms, the over-flow from these sewers passes directly to the receiving waters, since the volume is too great for the treatment plant to handle. The ever-present emphasis on pollution has focused much attention on not only combined sewers, but on untreated storm water from segregated sewers as well. In falling through the atmosphere, and in washing down buildings and streets which are covered with organic pollution, the storm waters become nearly as polluted as sanitary flows, and often times more so. All of the papers presented at the conference are concerned specifically with the abatement of pollution stemming from the use of combined

sewers. However, rather than reporting on methods sewers. However, rather than reporting on methods of changing the sewer systems, most research being done calls for treating both flows anyway. Methods discussed range from microstraining to air flotation to tunnels for storage before subsequent sea disposal. Combined sewer wastes can be treated at costs reported here ranging from 4 cents to 29 cents per 1000 gallons. From these reports and investigations it becomes apparent that the technology to clean up stormwater pollution is available, the gy to clean up stormwater pollution is available, the only thing lacking is its implementation. (See also W71-07979 thru W71-07989) (Lowry-Texas) W71-07978

OVERVIEW OF CONTROL METHODS.

Environmental Protection Agency, Washington,

Francis J. Condon. In: Combined Sewer Overflow Seminar Papers, p 9-17, Mar 1970. EPA Program 11020---03/70.

Descriptors: *Water pollution sources, *Sewers, *Infiltration, *Control systems, Treatment facilities, Control structures, Waste water treatment, Water pollution control.

Pollution problems caused by combined sewers and separate sewers that act as combined ones because of widespread infiltration and malfunctioning regulators are examined. Methods of control which are presently being investigated are discussed herein. (See also W71-07978) W71-07979

STORAGE AND TREATMENT OF COMBINED SEWAGE AS AN ALTERNATE TO SEPARA-

TION, Banister Engineering Co., St. Paul, Minn.

In: Combined Sewer Overflow Seminar Papers, p 19-36, Mar 1970. EPA Program 11020--03/70.

Descriptors: *Runoff, *Storms, Municipal wastes, Hydrographs, Floods, Sewers, Pumps, Storage, Ponds, Sampling, Odors, Maintenance, Waste water treatment.

Identifiers: Segregated sewers, Combined sewers.

A storm water storage pond has been constructed by the city of Chippewa Falls, Wisconsin. Com-bined sewers serve nearly all of the downtown section, and the city was ordered to separate the sewers to reduce the pollutional load on the Chip-pewa River. Availability of federal and state aid for development of alternatives to segregated sewers resulted in the design and construction of a holding pond system. A suitable area was located, and a pond of 10.7 acre feet was designed on the basis of data on a ten year storm. The pond was lined with a bituminous mat to facilitate cleaning and allow vehicular traffic within the pond for maintenance and grit removal. Concurrent with pond construction, additional pumping capacity was added to the pumping station, and secondary treatment facilities were added to the treatment plant. A sampling program was also instituted at this time. So far, there have been no flooded basements, no odor problems, and only two pond discharges, one of 67 mg/l BOD5 and the other of 27 mg/l BOD5. No cost estimate is presented for either the total project or the operating costs. However, problems have so far been few and maintenance has been minimal. (See also W71-07978) (Lowry-Texas) W71-07980

POLYMERS FOR SEWER FLOW CONTROL,

Environmental Protection Agency, Washington, D.C., Storm and Combined Sewer Control Branch.

George A. Kirkpatrick. In: Combined Sewer Overflow Seminar Papers, p 37-51, Mar 1970. 11 fig. EPA Program 11020---03/70.

Descriptors: *Pipes, *Roughness (Hydraulic), Resistance, Viscosity, Friction, Headloss, Hydraulic gradient, Turbulence, Laminar flow, Flow rates, Pressure, Temperature, Slurries, Biochemical oxygen demand, Activated sludge, Toxicity, Dewatering, Pumps. Identifiers: *Polymers, *Surcharging, Damping.

The reduction of pipe friction, with its corresponding increase in flow was the subject of a 29 month research and demonstration project. 6 polymers were tested as to their ability to decrease pipe friction. Of these, Polyox Coagulant-701 and WSR-301, both supplied by Union Carbide Co. and AP-30, supplied by Dow Chemical Co., were the most effective. Concentrations of 150-200 ppm of polymer caused flow increases of as much as 2.4 times the original flow. From laboratory testing, the project moved on to a 1563 ft. length 30 inches diameter sewer line in Dallas. 6 Piezometers were positioned, and provisions were also made for temdiameter sewer line in Dallas. 6 Piezometers were positioned, and provisions were also made for temperature measurement and sewage sample collection. Four runs were made to test Polyox WSR-301 and Polyox Coagulant-701 with polymer concentrations varying from 35-100 mg/l. These and other laboratory studies have yielded the following results: (1) polymers are non-toxic to bacteria found in sewage during these tests; (2) polymers have neither toxic nor nutrient effects on algae; (3) polymers are not toxic to fish; (4) a 500 mg/l concentration of polymer has a BOD5 of 1.56 mg/l; and (5) polymers aid in the dewatering of sludge. Addition of polymers to sewer lines in Garland, Texas to relieve surcharging of the lines is estimated to cost \$6400/year. Construction and operation of a relief sewer would cost \$27,000/year. tion of a relief sewer would cost \$27,000/year. Because of the promise shown in the initial research, much polymer research is continuing. (See also W71-07978) (Lowry-Texas) W71-07981

OVERVIEW OF TREATMENT METHODS, Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 05D. W71-07982

MICROSTRAINING WITH OZONATION OR CHLORINATION OF COMBINED SEWER OVERFLOWS,

Crane Co., King of Prussia, Pa. Cochrane Div.
W. A. Keilbaugh, G. E. Glover, and P. M. Yatsuk.
In: Combined Sewer Overflow Seminar Papers, p
59-99, Mar 1970. 11 fig, 5 tab, 10 ref. EPA Contract No 14-12-136.

Descriptors: *Storms, *Runoff, *Separation techniques, Screens, Filtration, Pumps, Headloss, Pressure, Chlorination, Coliforms, Cost analysis, Water pollution control, Waste water treatment. Identifiers: *Combined sewers, *Microstraining, Suspended solids, Ozonation.

Microstraining has been investigated as a possible treatment method for stormwater overflows from combined sewer systems. Suspended solids removals ranged from 78% to 98% using a 23 micron screen under relatively high throughput conditions. Lower throughput volumes resulted in a solids removal range of 62% to 96%, with 80% the average. Volatile suspended solids removals were directly correlated with suspended solids. BOD, on the other hand, actually increased in 8 to 17 measurements. Three possible explanations of these phenomena are: (1) natural predators of the bacteria are removed by the screen; (2) large bac-terial colonies are subdivided into larger numbers by straining; (3) the screening process makes the bacterial food supply more available. The last ex-planation seemed most likely. Also, increased oxidation at the point of entry will cause downstream effects to be less persistent. Further research is needed to determine the effects of using a still higher differential head. At this time, no operational problems have developed. A cost analysis shows barsercening, microstraining and chlorina-tion to cost from \$10,500 to \$12,800 per acre of area served. The cost of construction of separated sewers alone was estimated to be between \$20,000 to \$23,000 per acre. Since storm water, because of

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suspended and dissolved solids picked up from suspended and dissolved some proved at the street, houses, and the atmosphere, has come to be regarded as a pollutant in itself, the segregated sewers have little or no value. Therefore, development and refinement of the microstraining techniques should lead to wide spread applications in both combined and separated sewer systems. (See also W71-07978) (Lowry-Texas) W71-07983

OVERVIEW OF COMBINED CONTROL AND

TREATMENT METHODS, Environmental Protection Agency, Washington, D.C. Storm and Combined Sewer Pollution Control

William A. Rosenkranz.

In: Combined Sewer Overflow Seminar Papers, p 119-121, Mar 1970. EPA Program 11020---03/70.

Descriptors: *Control systems, *Storage, Water pollution control, Waste water treatment *Treatment methods, *Combined

The author contends that there is no single method of either control or treatment applicable as a complete answer to combined sewer problems. He further holds that engineering studies must consider all potential alternatives when seeking to determine a treatment method, and that physical control by storage must be considered in conjunction with potentially applicable treatment methods in order to achieve an optimal system. (See also W71-07985

ASSESSMENT OF ALTERNATIVE METHODS FOR CONTROL/TREATMENT OF COMBINED SEWER OVERFLOWS FOR WASHINGTON, D.C.,

Weston (Roy F.), Roslyn, N.Y.

John A. DeFilippi.

In: Combined Sewer Overflow Seminar Papers, p 123-138, Mar 1970, EPA Contract No 14-12-403.

Descriptors: *Water pollution control, *Storm runoff, Sampling, Hydrographs, Flow rates, Flood off, Sampling, Hydrographs, Frow Tates, Froot forecasting, Storage, Bacteria, Cost analysis, Filtra-tion, Biochemical oxygen demand, Chemical ox-ygen demand, Flocculation, Biological treatment. Identifiers: Combined sewers, Physical treatment, Suspended solids.

During periods of heavy rainfall, sewer systems collecting both sanitary wastes and stormwater over-load the treatment plant capacity and cause the direct discharge of an estimated 9.5 million lbs of BOD, 224 million lbs of suspended solids, 3.5 million lbs of total phosphates, and 1.0 million lbs of total nitrogen to receiving waters in the District of Columbia. These estimates were obtained from extensive sampling studies performed at three monitoring installations in the District of Columbia during 1969. The studies were performed to determine the characteristics of stormwater run-off, both in segregated sewers and combined sewers. Results indicated that significant pollutional loads are discharged from both types of sewers. Four alternative methods of abating the pollution from stormwater run-off include: (1) sewer separation; (2) off-system storage; (3) in-line treatment, and (4) miscellaneous. However, based on the initial samplings separation was ruled out. The remaining methods were analyzed according to the overall requirements for the entire area. Final costs estimates are not yet available, but these studies have demonstrated the feasibility of the regional sewerage plant in this instance. (See also W71-07978) (Lowry-Texas) W71-07986

MIDDLE LEE SETS THE STANDARD,

Surveyor, Vol 136, No 4075, p 45-46, July 1970.

Descriptors: *Water quality control, *Domestic Descriptors: "Water quanty control, "Domestic wastes, *Industrial wastes, Separation techniques, Sewage treatment, Activated sludge, Aeration, Filtration, Screens, Design criteria, Methane, Anaerobic digestion, Temperature, Biochemical oxygen demand, Fish, Toxicity, Water reuse, Tertiary treatment, Cost analysis, Waste water treatment,

Identifiers: *River Lee, Suspended solids, Grit, Great Britain, BOD5.

New Town development in the Lee Valley caused great concern that the already overloaded River Lee would deteriorate further and become merely an open sewer. This problem was especially impor-tant because the River Lee empties into the Chingtant because the River Lee empties into the Ching-ford Reservoir, which supplies 19% of the water supply of Metropolitan London. Final effluent stan-dards set in 1955 required that the effluent contain less than 5 mg/l SS in summer, and 10 mg/l SS in winter, less than 5 mg/l BOD in summer and 10 mg/l BOD in winter, and a free ammonia content of less than 10 mg/l under both summer and winter conditions. Construction was accomplished in three stages, the first stage having a capacity for 8 mgd. Stage 2 was of the same size as stage 1, however, the plant capacity had to be redesigned be-fore completion of stage 2. The final capacity of the finished plant was set at 30 mgd to compensate for rapid population growth. The treatment works consisted of screening, maceration, grit removal, and primary sedimentation. Secondary treatment of activated sludge using diffused air was provided, and tertiary treatment was assigned to rapid gravity sand filters. Primary and secondary sludge is digested anaerobically, and the sludge is distributed free as a top dressing or soil conditioner. Total plant cost was estimated at 6 million Pounds Sterling. Water quality rapidly improved after the new plant was put into operation, more than justifying the investment. (Lowry-Texas)
W71-07995

A MANAGEMENT ATTITUDE TOWARDS WATER CONSERVATION, Shell Canada Ltd., Corunna (Ontario).

T. A. McIver.

Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 3-10, June 7-10,

Descriptors: *Oil wastes, *Phenols, Industrial wastes, *Management, Engineering education, *Water pollution control, Sedimentation, Flotation, Saline water, Sewers, *Waste water treat-

Identifiers: *Segregated sewers, Canada.

The Shell Oil Company at Corunna uses 28 gallons of water for every gallon of crude processed, or 50 million Imperial gallons/day. The water is taken from the St. Clair river, and 95% is used once and returned to the river. The plant was constructed in 1952, and in 1955, the first biological treater for treating phenolic wastes in Canada was installed there. Since that time, in 1969, a larger API separator and trunk sewer line for oily water have been installed. A salt brine pond has also been constructed to prevent contamination of the river. The major reason for the small amount of pollution produced at the Corunna plant has been attributed mainly to good housekeeping within the plant itself. Education of all supervisory personnel on important factors of spillage prevention and control has signifi-cantly reduced both the oily discharges and the phenolic discharges from the plant. (Lowry-Texas) W71-08001

CONSERVATION, RECLAMATION AND RE-USE OF SOLIDS AND WATER IN POTATO PROCESSING, Manitoba Univ., Winnipeg. R. E. Gransfield, and R. A. Gallop. Proceedings, Ontario Industrial Waste Conference, 17th Nilpers Folls Outside p. 42.52 June 7.10 17th, Niagara Falls, Ontario, p 42-52, June 7-10,

Descriptors: *Industrial wastes, *Potatoes, Research and development, Pilot plants, Adsorption, Activated carbon, Microorganisms, Proteins, Water management (Applied), Sewers, Technical feasibility, Economic feasibility, *Water reuse,

Waste water treatment.
Identifiers: *By-product recovery, *Waste stream segregation, Lye peeling, Stem peeling.

Waste water management in the potato industry must be more carefully controlled to stop unnecessary discharges of large quantities of water to receiving waters. Separation of sewers and by-products recovery of starch have recently come to light as possible pollution abatement techniques. At the present time, processing of 750,000 lbs of raw potatoes per day requires in excess of 1 MGD of water, with a similar waste water flow. Current research work being conducted in the area includes the development of the day series which continues the development of the day series with a series was the development of the day series with a series was the development of the day series with the day of the development of the dry caustic peeling process, preparation of activated charcoal from waste potato solids, culturing of mixed microbial populations on solid potato wastes to produce high protein food supplements, and many others. The researchers at Manitoba University have also developed a chemical treatment process for potato wastes which is presently being tested on a pilot plant scale. Much further research work must be carried out before an optimal solution, both from the standpoint of technical and economic feasibili-ty, can be reached. (Lowry-Texas) W71-08004

APPLICATION OF AUTOMATIC SAMPLING TO TODAY'S WATER QUALITY CONTROL PROGRAMS, Gurnhamand Associates, Inc. Chicago, Ill.

Fred C. Gurnham, and Martha I. Beach.
Proceedings, Ontario Industrial Waste Conference, 17th, Niagara Falls, Ontario, p 109-118, June 7-10,

Descriptors: *Sampling, *Automatic control, Analytical techniques, Analysis, *Monitoring, Dissolved oxygen, Temperature, Flowmeters, Pumps, Weirs, *Water pollution control, Hydrogen ion concentration.
Identifiers: *Pump sampler, *Scoop sampler,

Vacuum sampler.

The following variables must be considered in the selection of automatic sampling equipment: (1) accessability of sampling site; (2) general character of the wastes; (3) flow patterns; and (4) analyses to be performed. To accommodate the preceding variables, there are 6 main types of samples, namevariations, there are of many speed analysis, (1) individual or 'grab'; (2) simple composite; (3) sequential composite; (4) continuous; (5) hand proportioned composite; and (6) automatic proportioned composite. Sampling equipment ranges in price from a few dollars to several thousand dol-lars, and in size from the portable to the permanent models. A brief description of the various samplers includes vacuum or compression samplers fixed volume and scoop samplers, cup or bucket elevator samplers, and pump samplers. The important service provided by a sample of adequate size, provision for preservation, and provision for containment until analyses can be performed. Growing concern with environmental pollution has caused much interest in monitoring pollutional parameters, but without a representative sample, all analyses per-formed are merely wasted. Therefore, specification, installation, and operation of automatic sampling devices must be considered a critical part of any waste survey. (Lowry-Texas) W71-08008

MINEWATER TREATMENT-INCO SUDBURY

DISTRICT OPERATIONS, International Nickel Co., of Canada Ltd., Toronto (Ontario).

For primary bibliographic entry see Field 05D. W71-08009

Group 5G—Water Quality Control

TECHNIQUES OF DEEP WELL DISPOSAL-A SAFE AND EFFICIENT METHOD OF POLLU-TION CONTROL,

American Industrial Disposal System Inc., Pittsburgh, Pa. Robert S. Stewart.

Proceedings, Ontario Industrial Waste Conference, 15th, p 37-43, June 9-12, 1968. 1 fig.

Descriptors: Water pollution control, *Deep wells, Geologic formations, Saline water, Gas, Oil, Cementing, Casing, Costs, *Waste water disposal.

The basic requirements for a deep well disposal system are: a subsurface horizon, preferably of sand stone filled with salt water, and located at a sufficient depth and suitable geological sequence so there might be no contamination of any water sources. The primary disadvantage or danger of the deep well disposal is the pollution of groundwater which could be limited through original program design. The techniques of drilling a deep well disposal system and equipping it in a satisfactory manner are derived from the oil and gas industry but with the primary concern that this well should be free of any possible defects that could allow contamination of potable water or mineral sources. This could be achieved by an elaborate control over the drilling, casing and cementing program. A schematic diagram showing all these factors is given. In general the cost of the deep well disposal is about one third of any other method of neutralization. (Rayyan-Texas) W71-08015

INCINERATION OF PROCESS INDUSTRY WASTES,

Trecan Ltd., Cooksville (Ontario). W. K. Lombard.

Proceedings, Ontario Industrial Waste Conference, 15th, p 43-60, June 9-12, 1968.

Descriptors: *Incineration, *Wastes, *Oxygen, Temperature, Turbulence, Liquids, Costs, Fuels, Disposal, *Waste treatment, *Waste disposal, Waste water treatment.

Combustion, or incineration is one of the effective methods of disposal of industrial wastes. Analysis of the wastes involved could determine the possibliity of this method. Incineration equipment should have air for oxygen and temperature, turbulence and time for good combustion. The types of wastes that could be handled by this method are: (1) rich liquids, (2) weak liquids, (3) halogenated liquids, (4) fumes and high heating, volume bulk materials. These wastes along with the suitable incinerator are discussed in detail including cost. An example of the cost range for a rich liquids incinerator of a 500 lb/hr burning capacity is \$10-15,000 while the cost of a 2000 lb/hr weak liquids incinerator is \$35-40,000 and would require 8 million BTU/hr of auxiliary fuel. Heat recovery from these incinerators is recommended only if the savings or by-products created will pay for the additional initial cost in no more than one year. An example case of a central disposal facility which is being constructed at Moore on the St. Clair river is reviewed. (Rayyan-Texas) W71-08016

PILOT PLANT STUDIES ON COMBINED DOMESTIC AND PAPER MILL WASTES. O'Brien and Gere, Syracuse, N.Y.

For primary bibliographic entry see Field 05D. W71-08017

ACTIVATED SLUDGE SYSTEM VARIATIONS. SPECIFIC APPLICATIONS.

Associated Engineering Services Ltd., Vancouver (British Columbia).

For primary bibliographic entry see Field 05D. W71-08018

NEW APPROACHES TO WASTE WATER

TREATMENT,
Cincinnati Water Research Lab., Ohio. For primary bibliographic entry see Field 05D.

SEWER FLOW MEASUREMENT IN A LARGE

INDUSTRIAL PLANT,
Polymer Corp., Sarina (Ontario).

D. D. Livingstone.

Proceedings, Ontario Industrial Waste Conference, 15th, p 146-156, June 9-12, 1968. 8 ref.

Descriptors: Treatment facilities, Survey, *Measurement, *Sewers, *Flow rate, Velocity, Costs, Sedimentation basin, *Current meter.

For accurate design of new pollution control facilities, and more accurate measurement of the actual performance of the treatment facilities, a survey scheme was developed in 1967 to measure all important discharges and identify the sources of these streams. The allowable error was 10%. Description of the plant and the treatment facilities with a plan layout is given. A recommended eight point survey plan is outlined. The measurement equipment used in this survey was the portable type, at a cost less than \$500. The Doll flow tube, the current meter, the pilot tube, bucket and stop watch (bucket was used for settling basin) and the salt dilution methods gave the required results within the allowable error and at a low cost. (Rayyan-Texas) W71-08020

THE ECONOMICS OF ALTERNATIVE METHODS OF WHEY DISPOSAL AT SOUTHERN ONTARIO CHEESE FACTORIES, Ontario Dept. of Agriculture and Food, Toronto.

R. W. Redelmeier, and D. A. MacDonald. Proceedings, Ontario Industrial Waste Conference, 15th, p 157-202, June 9-12, 1968. 8 tab, 14 ref.

Descriptors: *Nitrogen, *Hogs, *Waste disposal, Pollution disposal, Drying, Costs, Fertilizer, Foods, Water pollution control.

Identifiers: Whey, Cheese, Lactose, Spray drying, Roller drying.

Whey is the residual by-product in cheese making. It is 93% water, 4.9% lactose, .9% nitrogenous matter, .6% ash, .3% fat, and .2% lactic acid. For every 100 lbs milk used, 90 lbs are whey. Ontario produces one billion pounds of whey annually. Disposal of whey as hog feed and as waste is decreasing. Other advantageous methods of disposing of whey without causing pollution problems are spray or roller drying. An adequate supply of quality whey within reasonable trucking distance and sufficient demand at attractive prices for whey products are the conditions for satisfactory whey drying operations. Cost of whey drying ranges from \$30,000 for roller drying with a capacity of 27,000 lbs to \$1,055,000 for spray drying with a capacity of one million lbs. A variety of new whey products have been developed in Europe (vinegar and beverages). Research work on whey is under way in Canada, while in the U. S. considerable research has been done on the use of whey as an ingredient in the bakery industry, frozen food and related fields. By 1965, 100 whey processing plants existed in the U.S. However, further research is warranted not only on the production aspects of whey but on their marketing potential including consumer acceptance. (Rayyan-Texas) W71-08021

PHOSPHATE REMOVAL BY ACID HYDROLY-SIS AND CHEMICAL PRECIPITATION,

Ryckman, Edgerly, Tomlinson and Associates, Inc., St. Louis, Mo.

For primary bibliographic entry see Field 05D. W71-08022

DEFINING THE PROBLEM FOR INDUSTRIAL WASTE HANDLING AT HIRAM WALKER AND

Hiram Walker and Sons Ltd., Toronto (Ontario). Murray Sobolov.

Proceedings, Ontario Industrial Waste Conference, 15th, p 223-249, June 9-12, 1968. 12 tab.

Descriptors: *Sewers, *Measurement, Sampling, Effluents, Disposal, Biochemical oxygen demand, Industrial wastes, Water pollution control, Water pollution sources, Routing.
Identifiers: Suspended solids, *Sewer rerouting.

To assist in pollution control, Hiram Walker and Sons Ltd, analyzed their 110 year old factories to uncover all sources of pollution. Drawings showing uncover all sources of pollution. Drawings showing the sewer system were produced with the buildings contributing to the pollution. Sampling and flow measurements were taken. An explicit discussion on the above two points supported by tables and curves is presented. As a result, control of pollution will be handled by rerouting some sewers, a change of production equation, and collecting all polluted for the production restant which them effluents in a control collection system which then will flow to the city disposal plant. The remaining effluent which is about 75-80% of the total and is almost BOD free will be discharged in the river. (Rayyan-Texas) W71-08023

PALMER CORPORATION V COLLINS (CONTAMINATION OF OIL BY WATER SEEPAGE FROM NEGLIGENTLY ABANDONED OIL WELL).

For primary bibliographic entry see Field 06E. W71-08055

NORTHRUP V CITY OF JACKSON (ABATEMENT OF MUNICIPAL WASTE POLLUTION AND DAMAGES).

For primary bibliographic entry see Field 06E.

WATER QUALITY EVALUATION OF THE MIDDLE RIVER ROUGE BASIN. Michigan Water Resources Commission, Lansing.

Dept. of Conservation.

For primary bibliographic entry see Field 05A. W71-08128

OIL EXPLORATION ON GREAT BARRIER REEF.

Oucensland Littoral Society, Brisbane (Australia). D. W. Connell.

Marine Pollution Bulletin, Vol 1 (NS), No 12, p 188-189, Dec 1970. 2 fig, 1 tab, 3 ref.

Descriptors: *Leases, *Oil fields, *Drilling, *Reefs, Exploration, Environmental effects, Oil, Water pollution control.
Identifiers: *Great barrier reef, Australia.

The Royal Commission hearings into Great Barrier Reef Oil Drilling have been underway since July 1970 in Brisbanc, Australia. A map produced by the Queensland Mines Department is presented to show the location relationship of offshore leases to the reef, with the lease boundaries for the most part following the outer line of the reef. A significant Royal commission definition of the area of the Great Barrier Reef included the area outside the outer line of reefs. Potential offshore hydrocarbon bearing basins are illustrated with a Geological Survey of Queensland map. A table consisting of the hydrocarbon potential of each basin is given. (McEntry-PAI) W71-08156

DISPOSAL OF RADIOACTIVE WASTE FROM WINDSCALE,
Ministry of Agriculture, Fisheries and Food,
Lowestaft (England). Fisheries Radiobiological

N. T. Mitchell.

Marine Pollution Bulletin, Vol 1 (NS), No 11, p 172-174, Nov 1970, 1 fig, 7 ref.

Descriptors: *Radioactive waste disposal. *Water pollution sources, *Critical path method, *Water permits, *Regulation, Standards, Fuels, Nuclear wastes, Radioactive wastes, Effluents, Discharge,

Waste water.
Identifiers: *Windscale, *Irish Sea, *Reprocessing plant, Great Britain, Seaweed contamination, UKAEA, MHLG, MAFF.

The UKAEA's nuclear fuel reprocessing plant at Windscale reprocesses all fuel from nuclear power stations operated by the CEGB and the South of Scotland Electricity Board. The fuel is dissolved, chemically separated, evaporated to a small volume, and stored on the site. Some low level waste which accrues in large volumes of water is disposed of into the Irish Sea. Control of these sea disposals lies with the MHLG and the MAFF, which set strict authorization limits to minimize radioactivity exposure. The procedure is described whereby the UKAEA requested an increase in the rate of disposal authorized for alpha radioactivity. An intensive environmental monitoring and research program utilizes the critical path approach which evaluates the environmental behavior of the radioactivity discharged. The critical pathway at Windscale for alpha and beta radioactivity is contamination of Porphyra seaweed which is manufactured into laverbread eaten mainly in South Wales. Other less important exposure pathways are contamination of mud banks and consumption of locally caught fish. Actual radiation exposure in all these cases has been well within the ICRP recommendations. (McEntyre-PAI) W71-08161

MAGNETIC SYSTEM PICKS UP OIL FROM

Chemical and Engineering News, Vol 49, No 5, p

Descriptors: *Oil wastes, *Magnetic studies, *Equipment, Water pollution control, Oil, *Pollu-

tion abatement.
Identifiers: *Ferrofluids, *Magnetic cleanup, Oil spills, Magnets, Avco Corporation.

Avco Corporation is developing a magnetic cleanup of oil spills by using a ferrofluid consisting of a colloidal suspension of magnetic iron oxide in a light hydrocarbon carrier oil such as kerosine. This oil-soluble, water-insoluble ferrofluid solution produces a magnetic response due to the coupling of its magnetic particles with the surrounding carrier liquid. Thus when the ferrofluid solution is sprayed on oil slicks, the magnetic properties are conferred upon the oil phase so that a collecting magnet picks up oil with very little water entrained. The oil which accumulates between the magnet poles is collected with a vacuum hose and pumped into containers. Operative predictions for this system project a harvesting of 16 acres of oil slick per hour, or 12,500 gallons of oil of 1 mm. thickness, at a cost of less than \$1.00 per gallon. Another application of this ferrofluid system is for purification of oil refinery effluent streams. (M-cEntyre-PAI)
W71-08163

PROTOTYPE SYSTEM COREMOVES OIL FROM WATER. CONTAINS AND

Ocean Industry, Vol 6, No 1, p 19, Jan 1971.

Descriptors: *Oil wastes, *Separation techniques, Equipment, *Water pollution control, Oil, *Pollution abatement.

Identifiers: Oil spills, *Oil recovery system,

Headrick Industries Inc.

A complete open-ocean oil recovery system has been developed and tested by Headrick Industries, Inc., near Coal Oil Point, California. Included in the system are booms, towing harness, recovery

and transport vessel, and fabric tank. A description is given of the testing of the system. The oil separaon technique involves flow of a controllable and limited surface depth of water into an unagitated gravity separator where the oil is then skimmed off the surface and transferred to the oil storage tank. This recovery system can operate in varying slick and sea state conditions, with a maximum oil transfer capacity of 800 to 1500 gallons per minute. (McEntyre-PAI) W71-08164

INFORMATION AVAILABLE ON DISPOSAL OF SURPLUS PESTICIDES, EMPTY CONTAINERS AND EMERGENCY SITUATIONS. Working Group on Pesticides, Washington, D.C.

Available from the National Technical Information Service as PB-197 146, \$3.00 in paper copy, \$0.95 in microfiche. Working Group Report DR-3, Sept

Descriptors: *Pesticides, *Insecticides, *Waste disposal, Herbicides, Water pollution treatment, Landfills, Solid wastes, Sewers, Lagoons, Injection wells, Industrial wastes, Incineration,

Worst, industrial wastes, incineration. Identifiers: *Containers, Earth fills, Agricultural wastes, Air pollution control equipment, *Solid waste disposal, Sanitary landfills.

The information available on research in progress and recommendations on disposal methodology, pinpoint problem areas related to the disposal of surplus pesticides, wastes and empty containers in the first chapter. Sources of wastes, definitions for various disposal methods such as deep-well, sanitavarious disposal interloops as deep-went, santa-ry landfill, disposal pits, lagoons, surface or ground disposal, etc., estimates of number of empty con-tainers, and a list of companies who manufacture incinerators and flue gas scrubbers are included in its appendixes. Detoxification, handling, reconditioning and reuse of empty 55-gallon pesticide drums including decontamination by chemicals, decontamination by incineration and information needed on decontamination and drum reuse are presented in Chapter II WITH A LISTING OF FIRMS HAVING BURNING EQUIPMENT. Storage and handling pesticides and empty containers form Chapter III. Chapter IV is on detoxification of decontamination of transportation equipment and disposal and handling of pesticides or wastes resulting from accidents. Chapter V includes emergency assistance information and methods and an appendix on the National Agricultural Chemicals Association pesticide safety team network. Written by four authors from different federal agencies who formed a task group. W71-08173

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM,

Fresno County Planning Dept., Calif.

Available from the National Technical Information Service as PB-197 507, \$3.00 in paper copy, \$0.95 in microfiche. Grunwald, Crawford and Associates-Engineering Science, Inc. Summary Supplement Report, Mar 1970. 7 p.

Descriptors: *Regions, California, *Water supply, *Waste disposal, Sewers, Groundwater, Urbaniza tion, Economic aspects, Water reuse, Industrial wastes, Sewage treatment. Identifiers: *Regional planning.

The primary objective of the Water and Liquid Waste Program for the Central Fresno County Urbanizing Area has been to develop short-, medium-, and long-range programs for providing water supply and sewerage facilities from 1970 to 2015. A major emphasis of the study has been related to the protection of public health and the maintenance of groundwater quality and quantity in fu-ture years. The presentation which follows is a summary of the major findings, conclusions, and recommendations of the report with regard to (1) future growth requirements, (2) significant features of recommended water and sewerage systems, (3) the indicated financial requirements, and (4) considerations for implementing the recommended program.

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM. VOLUME V. MATHEMATICAL MODEL FOR GROUND-WATER.

Fresno County Planning Dept., Calif.
For primary bibliographic entry see Field 06B.
W71-08179

DOCUMENTATION REPORT-FWQA DYNAM-IC ESTUARY MODEL, Environmental Protection Agency, Washington,

D.C. Water Quality Office.

N.C. water Quanty Office. Kenneth D. Feigner, and Howard S. Harris. Available from the National Technical Information Service as PB-197 103, \$3.00 in paper copy, \$0.95 in microfiche. July 1970. 248 p, 50 fig, 7 tab, 22

Descriptors: *Mathematical models, *Estuaries, *Computer programs, *Hydraulic models, *Water quality, Dynamics, Flow, Dispersion, Biochemical oxygen demand, Dissolved oxygen, Regression analysis, Input-output analysis.

Identifiers: San Francisco Bay, San Diego Bay.

The necessary theory, background, and guidelines for applying the FWQA dynamic estuary model to an arbitrary estuary was presented. The discussion reflected FWQA experience in applying the model to the San Francisco and San Diego Bay estuaries. The model was utilized to simulate a wide variety of hydraulic and water quality conditions in these two systems, and through the course of its development, testing, and use, under-went significant change. The model represented the two-dimensional flow and dispersion characteristics of an estuary and could be applied to any estuary wherein vertical stratification was either absent or limited to relatively small areas within the estuary. The model could accommodate both conservative constituents including the interrelationship between biochemical oxygen demand (BOD) and dissolved oxygen (DO). Two separate, but compatible components were developed: a hydraulic program (DYNHYD) and a quality program (DYNQUA). A third program, a harmonic regression analysis (REGAN) was utilized to reduce input requirements for specifying the tidal conditions imposed on the system. A hydraulic extract program (HYDEX) summarized the hydraulic output while a quality extract program (QUALEX) summarized the output from the quality program. A final program (DATAP) was developed to prepare basic inputs to the hydraulic program. Kriss-Cornell) W71-08189

APPLICATION OF USER CHARGES TO WATER QUALITY MANAGEMENT, Chicago Univ., Ill. Graduate School of Business. Charles Upton.

Water Resources Research, Vol 7, No 2, p 264-272, Apr 1971. 9 p, 4 tab, 15 ref.

Descriptors: *Optimization, *Taxes, *Water quality control, *Costs, Pollutants, Dissolved oxygen, River basins.

Identifiers: *User charges, Miami River.

The relative effects of optimal taxes and user charges were investigated for the Miami River basin in Ohio, and the user charges appeared preferable to the optimal tax. First, some previous studies and the geography of the Miami River basin were discussed. For the model three functions were estimated: the cost of treatment for each plant, the cost augmentation, and the water quality function. It was shown that the authority will incur a loss if the optimal tax was used and this deficit makes them undesirable. With the alternative of user

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G-Water Quality Control

charges each firm that discharges pollutants pays a 'share' of the cost of centralized treatment. Two schemes were proposed to determine what share of the costs would be borne by each firm: (1) in-creased permissible waste load method, and (2) waste load discharge method. The effect of dif-ferent choices for the water quality standard was examined by computing 11 levels of dissolved ox-ygen for the Miami River. The minimum cost of meeting each of the standards was calculated and the efficient production locus was thus obtained. If taxes were levied to achieve the minimum cost of water quality standard, the receipts would pay about 85% of the cost. User charges would erase this deficit at an additional total cost of only about 1 percent. (Kriss-Cornell) W71-08196

WASTE OPTIMAL CHERYSHEV DISCHARGES,

Yale Univ., New Haven. Matthew J. Sobel. Supported by National Science Foundation. Operations Research, Vol 19, No 2, p 308-322, Mar-Apr

Descriptors: *Optimization, *Waste treatment, *Water quality, *Storage capacity, Linear programming, Dynamic programming, Discharge measurement, Water resources. Identifiers: *Chebyshev criterion.

A model for evaluating alternative schedules for storing wastes and discharging stored wastes into a water resource was provided. The central problems were (1) for a given capacity, what discharge schedule maximizes the minimum water quality during a finite horizon, and (2) for a given minimum water quality during a finite horizon, what is the smallest storage capacity for which there exists a feasible discharge schedule. Problem (1) used a Chebyshev criterion where the problem was to find a point in the domain that minimized the maximum among the functions (or maximized the minimum among the functions). The suitability of a Chebyshev criteria for water quality problems was discussed. Then problems (1) and (2) were given deterministic formulations and the terminology of a holding-pond problem was used for ease of exposition. The nonlinear-programming problems based on (1) and (2) shared a base-level property and the computational consequences were developed including a simple algorithm for problem (2). A special case when the programming problems were linear and seasonal was investigated. Problems (1) and (2) were also posed as dynamic programming problems in order to prove the existence of an optimal discharge schedule possessing the base-level property. (Kriss-Cornell) W71-08197

DESIGN OF SEWER SYSTEMS,

Wisconsin Univ., Milwaukee. Coll. of Applied Science and Engineering.
J. M. Fisher, G. M. Karadi, and W. W. McVinnie.
Water Resources Bulletin, Vol 7, No 2, p 294-302, Apr 1971. 9 p, 4 fig, 7 ref.

Descriptors: *Optimization, *Linear programming, *Sewers, *Design, *Cost, Pipes, Co Depth, Slopes, Size. Identifiers: Iteration process, Algorithms. *Cost, Pipes, Constraints,

The objective of this paper was to review and evaluate the merits of certain methods aimed at finding optimal solutions in sewer design. First, basic principles of sewer design were outlined. Then a linear integer programming algorithm, based on principles similar to the ones proposed by Deininger and Holland, was developed in which cost was expressed as a function of the pipe diameter and slopes. In order to show the application of the programming algorithm and to find out what difficulties are encountered in an actual problem, it was applied to an existing design of an interceptor sewer to be built in the Chicago metropolitan area

and composed to a traditional approach. A computer program based on the SIMPLX method was developed to find the optimum pipe diameter, invert depths and slopes based on the objective cost function and subject to certain given constraints. An iteration process was used for the solution. The results of the optimization were summarized and a 10% difference was found between the results of the new algorithm and results of the traditional approach shown. In conclusion it was stated that this new optimization technique cannot be considered new optimization technique cannot be considered as substantial improvement with respect to tradi-tional methods. (Kriss-Cornell)

FARM ANIMAL-WASTE MANAGEMENT. lowa State Univ., Ames. Dept. of Agricultural En-

Miner, J Ronald (Ed). North Central Regional Publication 206, Special Report 67, May 1971. 44 p, 34 tab, 85 ref.

Descriptors: *Farm wastes, *Disposal, Waste water treatment, *Management, Hydroponics, Incineration, Pollutants, Diseases, Design criteria, Anaerobic digestion, Aerobic treatment, Aerobic bacteria, bic digestion, Aerobic treatment, Aerobic bacteria, Zoonoses, Anaerobic bacteria, Farm lagoons, Chemical properties, Physical properties, Pathogenic bacteria, Environmental effects. Identifiers: Composting, Oxidation ditches, Ruminant digestion, Nonruminant digestion, Disease transmission, Feedlot-runoff.

Current practices, technology, knowledge, and research results are summarized as related to the management and disposal or use of farm animal wastes in the 13 states of the North Central Region and other cooperating states. Among alternative systems of management and treatments described, attention is given to relative effectiveness in eliminating or minimizing detrimental environmental and ecological consequences. Detailed informa-tion is included on the biology and biochemistry of waste treatments; characteristics of animal wastes, including biological, physical, and chemical properties; aerobic, anaerobic, and combined treatments of animal wastes; composting, incineration, dehydration, and hydroponics; and actual and potential productive utilization of animal wastes. Needs for additional research are suggested. (Christenbury-Iowa State) W71-08209

LEGAL ASPECTS PERTAINING TO ENVIRON-MENTAL REGULATIONS IN PORK PRODUC-TION.

Missouri Univ., Columbia. Dept. of Agricultural Economics.

American Pork Congress - Proceedings, Environmental Quality Workshop, Des Moines, Iowa, Mar 3, 1971. p 103-111.

Descriptors: *Fa.m wastes, *Legal aspects, Water pollution, Air pollution, Public rights, Regulation, Judicial decisions, Damages, Zoning, Permits, Maintenance, Water pollution control.

Identifiers: Public regulation, Private regulation, Nuisances, Legal principles, Lawsuits, Liability, Actual damages, Punitive damages, Site selection.

Public and private regulation of both air and water pollution is provided by pollution boards or com-missions and through nuisance laws. Two lawsuits are discussed so that the legal principles involved might help determine what courses of action will help avoid such situations. In a nuisance law case the complaining party may ask for (1) an injunction, (2) damages (either actual or punitive), or (3) both an injunction and damages. The nuisances involved may be either public or private. A plaintiff may have a better chance if the rights of the public are being affected. Methods of avoiding lawsuits include the use of zoning, site selection, licensing, proper maintenance, adequate facilities, and being a 'good neighbor.' (White-Iowa State) W71-08210

CONFINEMENT REARING OF TURKEYS, Amerine National Corp., Oakdale, Calif. Hastings

Poultry Digest, p 110-112, Mar 1971. 2 fig.

Descriptors: *Ventilation, *Management, *Confinement pens, Farm wastes, Equipment, Hazards, Poultry, Water pollution control. Identifiers: *Psychrometric chart, Overventilation,

Some management functions that can lead to max-Some management functions that can lead to maximzing returns from turkey production are discussed. To get the most out of any ventilation system, whether it is positive or negative pressure, knowledge of psychrometrics by the person doing the ventilating is essential. It is possible to overventilate a total confinement house or to underventilate it. Much can be gained from having thermostats located outside where outdoor conditions can be used to provide a better environment inside. Good, not necessarily new, in-house equipment is vital for optimum results from confinement production. (Christenbury-lowa State)

HOW CAN PORK PRODUCERS COMPLY WITH ENVIRONMENTAL QUALITY STANDARDS,

Iowa State Univ., Ames. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D. W71-08214

THE EFFECTS OF SALINITY STANDARDS ON

THE EFFECTS OF SALINITY STANDARDS ON TRRIGATED AGRICULTURE IN THE COLORADO RIVER BASIN,
Federal Water Pollution Control Administration,
Boulder. Colorado River - Bonneville Basins Of-

Gary N. Dietrich, and L. Russell Freeman.
In: Water Quality Management Problems in Arid
Regions, Water Pollution Control Research Series,
13030 DYY, 6/69, Oct 1970, USDI, Federal Water Quality Administration, p 9-15.

Descriptors: *Salinity, *Water quality, *Standards, Colorado River, *Irrigation, Evapotranspiration, Desalination, Flow augmentation, Consumptive use, Water pollution effects.

Identifiers: *Salinity criteria, Irrigation cycle,

Salinity-source abatement.

This paper discusses salinity criteria for the Colorado River Basin. The problem faced in water quality management in the Colorado River Basin is one of improving existing mineral quality, or at least, minimizing future salinity increases. Consumptive use of water in crop production complicates developing salinity criteria for the Colorado River Basin. There are only two direct colorado River Basin. There are only mapproaches to implementing salinity criteria: the regulation of consumptive water uses and the desalination of waters whose salinity has been concentrated by consumptive use. Three salinity control approaches which do not necessarily depend on the establishment of criteria are: the abatement of salinity at selected sources including natural sources, the augmentation of river flows, and the desalination of water for use. (See also W71-06111) (White-Iowa State) W71-08222

NITRATE REMOVAL FROM AGRICULTURAL

WASTE WATER, Federal Water Pollution Control Administration, Fresno, Calif.; and California Dept. of Water Resources, Fresno. For primary bibliographic entry see Field 05D. W71-08223

WATER QUALITY REQUIREMENTS AND RE-USE OF WASTE WATER EFFLUENTS, Federal Water Pollution Control Administration,

Washington, D.C.

For primary bibliographic entry see Field 05D.

W71-08224

SALINITY CONTROL IN RETURN FLOW FROM IRRIGATED AREAS - A DEMONSTRA-

TION PROJECT,
Colorado State Univ., Fort Collins. Natural
Resources Center. Norman A. Evans.

Norman A. Evans. In: Water Quality Management Problems in Arid Regions, Water Pollution Control Research Series, 13030 DYY, 6/69, Oct 1970, USDI, Federal Water Quality Administration, p 45-55. 7 fig.

Descriptors: *Salinity, *Return flow, *Irrigation, Colorado River, Salt balance, Canal seepage, Deep percolation, Evapotranspiration, Electrical conductance, Base flow.
Identifiers: Salt load.

The purpose of this paper was to summarize a demonstration project which has been initiated in the Grand Valley area of Colorado for the purpose of showing that saline agricultural return flows are controllable and that if improvements in water management practices are applied, the salt load returning to the river will be reduced. A discussion is given on the mechanics of return flow. Six irrigation companies, a power company and desirable tion companies, a power company, and a drainage district combined resources to form a corporation for the purpose of conducting the demonstration and study. The first step was a before treatment in-ventory of water and salt budget in the demonstraventory of water and salt budget in the demonstra-tion area. Canal seepage losses have been mea-sured and a plan for lining certain sections is being formulated. Many water flow measurements are being made. Evapotranspiration estimates will be made. Groundwater flow will be calculated from hydraulic gradient and permeability data. Self-monitoring the Colorado River will afford the final evidence of positive benefit from reduction in canal seepage. The reduced canal seepage should reduce by 1/2 the volume of return flow, and affect a sig-nificant reduction in salt load. (See also W71-06111) (White-lowa State) W71-08225

WATER QUALITY CONTROL PROBLEMS IN

WATER QUALITY CONTROL PROBLEMS IN INLAND SINKS,
Federal Water Pollution Control Administration,
Alameda, Calif. California/Nevada Basins.
Richard C. Bain, Jr., and John T. Marlar.
In: Water Quality Management Problems in Arid
Regions, Water Pollution Control Research Series,
13030 DYY, 6/69, Oct 1970, USDI, Federal Water
Quality Administration, p 57-77. 8 fig, 2 tab, 10 ref.

Descriptors: *Water quality, *Salinity, *Sinks, Eutrophication, Fish, Dissolved oxygen, Tempera-ture, Nutrients, Evaporation, Water level fluctua-tions, Nevada, California. Identifiers: Pyramid Lake (Nev), Salton Sea (Calif), Total dissolved solids, Surface area.

The problems of Pyramid Lake, Nevada, and Salton Sca, California, are similar in many ways and are common to other inland sinks. Salinity increases and water level fluctuations attributable to water and salt inflows and evaporation losses may be controlled or abated through river basin and water quality management schemes. Pyramid Lake water levels and the rate of salinity increases can be controlled by increasing the water supply to the Lake. Salton Sea salinity and water level problems can be better controlled by salt extraction, lower irrigation efficiencies in nearby agricultural areas, bulkheading on developed parts of the shore, and possible future evaporation pond operation. Eutrophication symptoms, advanced in the Salton Sea and emerging in Pyramid Lake, are less easily manipulated. Natural forces of deposition and consumption of organic matter within these waters will tend to limit nutrient buildup; however trapping and predation effects alone will not eliminate algal blooms. Control of eutrophication must begin with control or elimination of major nutrient sources. It is clear that unless water quality control measures are taken, both bodies of water will eventually become aqueous deserts. Local, State and Federal

efforts are underway to preserve or enhance the water quality and associated uses of these two in-land sinks. (See also W71-06111) (White-Iowa State) W71-08226

DISTILLATION OF WASTE WATERS: A WATER RESOURCE FOR ARID REGIONS, Federal Water Pollution Control Administration, Washington, D.C. Office of Research and Develop-

For primary bibliographic entry see Field 05D. W71-08227

THE REFUSE ACT OF 1899: NEW TASKS FOR AN OLD LAW,

For primary bibliographic entry see Field 06E. W71-08228

MICHIGAN ENVIRONMENTAL PROTECTION **ACT OF 1970,**

For primary bibliographic entry see Field 06E. W71-08230

EFFLUENT CHARGES: WATER POLLUTION CONTROL,

For primary bibliographic entry see Field 06E. W71-08231

UTILITY INDUSTRY AND SECTION 21 (b) OF THE FEDERAL WATER POLLUTION CONTROL ACT, For primary bibliographic entry see Field 06E. W71-08232

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO CHANGE THE TREATMENT WORKS CONSTRUCTION PROGRAM.

For primary bibliographic entry see Field 06E. W71-08234

OILY-WATER SEPARATORS AND SEWAGE DISPOSAL SYSTEMS: VESSEL REQUIRE-

For primary bibliographic entry see Field 06E. W71-08239

STANDARDS FOR PROTECTION AGAINST RADIATION.

Atomic Energy Commission, Washington, D.C. For primary bibliographic entry see Field 06E. W71-08242

NATIONAL MARINE WATERS POLLUTION CONTROL AND QUALITY ENHANCEMENT ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT).

For primary bibliographic entry see Field 06E. W71-08247

THE ROLE OF THE COURT IN PROTECTING THE ENVIRONMENT--A JURISPRUDENTIAL

ANALYSIS, For primary bibliographic entry see Field 06E. W71-08249

ENVIRONMENTAL LAW-NUISANCE--IN-JUNCTIVE RELIEF DENIED IN PRIVATE AC-TION FOR NUISANCE CAUSED BY INDUSTRI-AL POLLUTER.

For primary bibliographic entry see Field 06E. W71-08250

ENVIRONMENTAL REPORTS FOR NUCLEAR POWERPLANTS.

Atomic Energy Commission, Washington, D.C. For primary bibliographic entry see Field 06E. W71-08251

ENVIRONMENTAL QUALITY.

Department of Agriculture, Washington, D.C. For primary bibliographic entry see Field 06E. W71-08252

OIL POLLUTION FROM SHIPS.

For primary bibliographic entry see Field 06E. W71-08253

ENVIRONMENTAL LITIGATION-WHERE THE ACTION IS,

For primary bibliographic entry see Field 06E. W71-08256

AN ACT RELATING TO THE PUBLIC AND EN-VIRONMENTAL HEALTH AMENDING THE FLORIDA AIR AND WATER POLLUTION CONTROL ACT BY PROVIDING ADDITIONAL GROUNDS FOR INJUCTIVE RELIEF.

For primary bibliographic entry see Field 06E. W71-08258

AN ACT RELATING TO THE DEPARTMENT OF AIR AND WATER POLLUTION CONTROL: ENFORCEMENT PROCEDURE FOR TEMPO-RARY AND NON-CONTINUING VIOLATIONS. For primary bibliographic entry see Field 06E.

THE ECONOMICS OF POLLUTION AND THE INTERDISCIPLINARY APPROACH TO EN-VIRONMENTAL PLANNING,

Technische Hochschule, Darmstadt (West Ger-

For primary bibliographic entry see Field 06A. W71-08264

WATER QUALITY STANDARDS: ENFORCE-MENT AND COMPLIANCE, Federal Water Quality Administration, Washing-

ton, D.C.

Murray Stein.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 157-181,

Descriptors: *Water law, *Water Quality Act, *Regulations, *Thermal powerplants, Legislation, Water pollution control, *Standards.

Identifiers: Law enforcement, Temperature

The author presents the policy of the Federal Water Quality Administration and the Department of the Interior in the procedures for establishment of water quality standards and means of their enforcement in the USA. The Federal Water Quality Administration's concern is that all types of power generating units should be subject, insofar as practicable, to regulation on a similar and nondiscriminatory basis with respect to other industrial processes. All of the states included temperature criteria as part of their water quality standards submissions. Administration legislative proposals are also presented together with certification of standards compliance and the Water Quality Improve-ment Act of 1970. The three stage enforcement procedure - the conference, the public hearing and court action - is presented through the example of Biscayne Bay pollution with thermal discharges from one of Florida's power plants. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08305

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Group 5G—Water Quality Control

PRACTICAL IMPLICATIONS OF APPLYING CRITERIA IN A VARIETY OF CONDITIONS, Bureau of Sport Fisheries and Wildlife, Washing-

ton, D.C. R. E. Johnson.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 183-187,

Descriptors: *Thermal pollution, *Thermal power-plants, *Environmental effects, Water quality control, Heat, Beneficial use, *Standards.

The conglomeration of water standards admittedly is troublesome but may be inevitable. The attitude toward more rigid, higher standards is justified by our insufficient knowledge and the fact that we cannot afford risks with the biota. The destruction of an aquatic or terrestrial community by some environmental change may not seem important at times, but the community may not be replaceable in that area. The author polemizes with some of the popularized views pointing out that, for example, even brief entrainment of organisms through a cooling system may be harmful some distance below the discharge, or that heat is not always the only concern with metal ions and biocides present; or, that in some instances a few degrees of rise in water temperature can change a desirable fish fauna into an unacceptable group of species. There will never be a better time to plan, design and construct for future needs. The cost will never be lower and the long-term benefits will never be greater. (See also W71-08298) (Oleszkiewicz-Vanderbilt)

DEVELOPING AND APPLYING STANDARDS AT THE STATE LEVEL,

Pennsylvania Dept. of Health, Harrisburg. Div. of Water Quality.

R. M. Boardman.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 213-227,

Descriptors: *Standards, *Regulations, *Temperature, *Thermal pollution, *Cooling water, *Water quality control, Fish, Biota, Surface waters, Thermal powerplants, Nuclear powerplants, *Pennsyl-

Identifiers: *Susquehana River, Fish pathways.

Pennsylvania's Sanitary Water Board thermal discharge regulations, adopted in 1961, are presented, followed by the discussion of water quality standards included in the amendment adopted in 1965. The heat content of discharges shall be limited to an amount that could not raise the temperature of the entire stream at the point of discharge 5F above ambient temperature or maximum of 87F, whichever is less; nor change the temperature by more than 2F during any one hour period assuming complete mixing. For a stream capable of supporting a cold water fishery, the maximum temperature is 58F, the increase remaining 5F. A fishway will be required in streams receiving heated discharges where this is essential for preservation of migratory pathways of game fish or for preservation of important aquatic life. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08308

ENVIRONMENTAL INFLUENCE ON POWER OPERATION,

American Electric Power Service Corp., New York

John Tillinghast.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power. Gordon and Breach, New York, p 281-294,

Descriptors: *Water law, *Regulations, *Thermal powerplants, *Thermal pollution, Cooling, Heat, Environmental effects, Economic feasibility, Standards, Nuclear powerplants, Lake Michigan, Ohio

Due to low electric generation efficiencies, up to 75% of the potential chemical energy fails to be converted to electricity and must be rejected to the environment in the form of heat. Public opinion cannot expect power systems to be able to adjust their operation to limitations which are imposed by environmental regulations unless they are designed to do so. Attempts to conform operation to these limitations will result in compromises which, taken on the whole, are more detrimental than they are beneficial to the environment. In developing regulations, environmental considerations must be subjected to the same standards and scrutiny which we require of all technologies. They must be supported by experimental data, not be conjecture, and their economic ramifications must be carefully considered. (See also W71-08298) (Oleszkiewicz-Vanderbilt) W71-08312

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

USE OF LINEAR PROGRAMING FOR ESTI-MATING GEOHYDROLOGIC PARAMETERS OF GROUNDWATER BASINS, General Electric Co., Santa Barbara, Calif. Center

for Advanced Studies.

David Kleinecke.

Water Resources Research, Vol 7, No 2, p 367-374, Apr 1971. 8 p, 1 tab, 8 ref. OWRR Project C-1339 (No 1971) (3).

Descriptors: *Simulation analysis, *Linear programming, *Hydrogeology, *Parametric hydrology, *Aquifer characteristics, Groundwater basins, Storage coefficient, Water storage, Permeability, Systems analysis, Mathematical models, Data collections, Data processing, California, Computer

programs. Identifiers: *Simulation models.

Simulation models of groundwater basins require that values be given for geohydrologic parameters such as permeability and storage capacity. These parameters may be estimated and later adjusted by trial and error to improve the ability of the model to simulate some known portion of the water history, or this process might be reversed to deduce geohydrology directly from the historical record. This suggestion was tested against a basin studied earlier by the California State Department of Water Resources. The fitting criteria used gave rise to linear programing formulations which were solved from the basin data. About one-third of the basin parameters were evaluated, but further development is required. It is believed that historical records, although apparently overdetermining the system of equations, actually underdetermine the system because of redundancy effects. The ap-proach appears to offer the best known method for estimating the effective aquifer depth. W71-07704

OPTIMAL USE OF COUPLED LEAKY AQUIFERS,

New Mexico Inst. of Mining and Technology, Socorro.

For primary bibliographic entry see Field 04B.

W71-07916

THE CHANCE A FLOOD WILL BE EXCEEDED IN A PERIOD OF YEARS,

Conservation Service, Berkeley, Calif. Watershed Planning Party.

E. Morton Markowitz

Water Resources Bulletin, Vol 7, No 1, p 40-53, Feb 1971. 14 p, 5 fig, 14 ref.

Descriptors: *Floods, *Probability, *Frequency analysis, Distribution patterns, Statistical methods, Time series analysis, Reviews.

Identifiers: *Binomial distribution, Recurrence in-

Terms commonly used in work involving flood frequency estimates are reviewed. Five graphs and two tables are presented to facilitate the use of statistical methods in solving problems met in hydrology. Examples are used to illustrate the terms, graphs and tables, and to familiarize the hydrologist with the potential of the biomial distribution as a solid in flood force and the second seco tribution as a tool in flood forecasting. The relationship between the binomial distribution and the normal distribution offers the most intuitive explanation of the normal distribution available. (Knapp-USGS)
W71-08058

ELECTRIC ANALOG MODEL STUDY OF THE HYDROLOGY OF THE SAGINAW FORMATION IN THE LANSING, MICHIGAN AREA-

Michigan State Univ., Lansing. Dept. of Geology. For primary bibliographic entry see Field 04B. W71-08184

APPENDIXES TO THE USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK STATE, New York State Department of Environmental Conservation, Albany. Div. of Water Resources. A. C. Tedrow, C. S. Liu, D. B. Halton, and R. A. Hiney.

Available from the National Technical Information Service as PB-199 540, \$3.00 in paper copy, \$0.95 in microfiche. Vol II, June 1970. 148 p, 7 fig, 38 plates. OWRR Project C-1126 (No 1586) (1).

Descriptors: *Systems analysis, *Water resources development, *Water management (Applied), *Decision making, *Analytical techniques, Computer programs, Input-output analysis, Digital com-

Identifiers: Transition function, Flow diagrams.

Six appendixes were presented as a supplement to the study on the use of systems analysis in the development of water resources management plans for New York State. Appendix A showed that the allocation problem of a multi-reservoir river system involves three decisions: the storage operation, the diversion operation, and the release operation yet only two are independent. A dynamic programming technique was applied to decompose the gramming technique was applied to decompose the two-decision for the river system management model were described in Appendix B where the aim was to provide methods which stored information in an analytical form. The next appendix involved the development of the river system transition function employed in the management model to function employed in the management model to define and reduce the feasible ranges of the various systems operations. Appendix D presented flow charts and program listings for the River System Management Analysis and typical input and output data from the Oswego River Basin operations study. Appendix E was included to more fully explain the education of the Oswego Conservation Model to dy. Appendix E was included to indice taily explain the adaption of the Oswego Conservation Model to a high speed digital computer. Documentations of the Flood Routing Model Program in Appendix F included description of the model program, definitions of the variable names used, generalized flow diagrams, and computer program listings. (See also W71-08185) (Kriss-Cornell) W71-08186

COMPUTER PROGRAM FOR STATISTICAL ANALYSIS OF ANNUAL FLOOD DATA BY THE LOG-PEARSON TYPE III METHOD, Minnesota Univ., Minneapolis. St. Anthony Falls

Hydraulic Lab.

C. Edward Bowers, Arthur F. Pabst, and Stephen P.

Techniques of Planning—Group 6A

Available from the National Technical Information Service as PB-199 541, \$3.00 in paper copy, \$0.95 in microfiche. Computer Program No 1, Jan 1971. 32 p, 11 fig, 2 tab, 4 ref, 3 append.

Descriptors: *Computer programs, *Statistical methods, *Flow control, *Flood, Streams, Inputoutput analysis, Data.
Identifiers: *Log-Pearson type III distribution,

The adoption of a uniform method of establishing flood flow frequencies by use of the log-Pearson Type III distribution by the Water Resources Council was discussed. The objective was to obtain consistent estimates of flood frequencies. The method used first transforms the natural data to their logarithms and then computes the statistical parameters. The basic equations associated with the log-Pearson Type III distribution were included although it is not necessary to go through the process of solving these equations since the dimensionless probability distribution was provided in table form. With the table available the primary problem was determinization of logarithms of the floods and the mean, standard deviation, and skewness of the logarithms. The computer program used was written in Fortran IV language and was included in the appendix. The example used illustrated the input and output data for annual floods on two Minnesota streams. The log-Pearson Type III distribution appeared to have an advantage over other distributions commonly used in flood frequency analysis in that it could be used with data having skewness coefficients other than one. To illustrate its use, it was applied to selected streams in the United States. (Kriss-Cornell)

DOCUMENTATION REPORT--FWQA DYNAM-IC ESTUARY MODEL, Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 05G. W71-08189

RANDOM-WALK MODEL OF STREAM NET-WORK DEVELOPMENT, IBM Watson Research Center, Yorktown Heights,

N.Y.

For primary bibliographic entry see Field 07A. W71-08190

DESIGN CONDUIT SYSTEM BY DYNAMIC PROGRAMMING,

Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 08B. W71-08191

SOME EFFICIENT DYNAMIC PROGRAMMING ALGORITHMS FOR THE OPTIMAL SEQUENCING AND SCHEDULING OF WATER SUPPLY PROJECTS,

Case Western Reserve Univ., Cleveland, Ohio. A. M. O. Esogbue, and Thomas L. Morin.
Technical Memorandum No 192, Operations Department, School of Management, Case Western
Reserve University, Contract DAHC 19-68-C-0007, July 1970. 23 p, 3 fig, 2 tab, 3 ref, 2 append.

Descriptors: *Dynamic programming, *Optimiza-tion, *Water supply, *Sequence, *Scheduling, Time, Costs, Water demand, Project planning, Effi-

Identifiers: Algorithms.

The purpose of this paper was: (1) to show that the dynamic programming algorithm presented by Butcher, Haimes and Hall for optimal sequencing of water supply projects, and referred to as DPI, could be modified to solve a much more general class of problems, the scheduling problem and (2) to present a more efficient dynamic programming algorithm, DP2, for solving both the sequencing

and scheduling problem. The sequencing problem involved sequencing (timing) the construction completion dates of each of the N projects so that water demand will always be met and the sum of present costs of the N projects will be minimum. The scheduling problem considered was where N independent water small resident in the scheduling problem. independent water supply projects were given and it was desired to select some subset of them to be constructed and then to sequence their completion times. A basic permutation schedule theorem was presented upon which DP2 was based and proof of the theorem was given in the appendix. The computational superiority of DP2 over DP1 for the sequencing problem was illustrated by solving a simple example posed by Butcher, Haimes and Hall. It was shown that the advantages of DP2 over DP1 increased size and complexity of a given problem. Efficient relevant algorithms capable of being utilized, with present day computational devices, to solve the problems encountered in water resources systems were produced. (Kriss-Cornell) W71-08193 constructed and then to sequence their completion W71-08193

INTRODUCTION TO BAYESIAN METHODS USING THE THOMAS-FIERING MODEL,

Kansas City Univ., Manhattan. W. J. Conover.

Supported by U. S. Geological Survey. Water Resources Research, Vol 7, No 2, p 406-409, Apr

Descriptors: *Mathematical models, *Decision making, *Estimating, *Risks, *Correlation analysis, Investment, Computers, Dam design.

Identifiers: *Bayesian methods, *Thomas-Fiering model, Loss function.

A mathematical model was used to estimate unknown parameters of investment decisions in water resources. This Bayesian approach to estimation involved use of the estimator that minimized the expected risk, where risk was the expected loss. Bayes estimators might be used in a wide variety of situations for which probabilistic models have been specified. In an example, a Bayes estimator of the serial correlation coefficient (p) in streamflow was shown to be a weighted average of the sample serial correlation coefficient (r) and the mean of all population serial correlation coefficients. The density of p was called the 'posterior density' when r was given, as opposed to the 'prior density' when r was not known. The posterior density was combined with the loss function to show that (1) if the loss function was the squared error loss function, the Bayes estimator was the mean of the posterior density; (2) if the loss function was the absolute deviation loss function, then the Bayes estimator was the median of the posterior density; and (3) if the loss function was almost constant then the Bayes estimator was the mode of the posterior density. Also, it was shown that the methods of Bayes' estimation do not lend themselves to numerical methods as performed on a computer. (Kriss-Cornell) W71-08194

OPERATING RULES FOR JOINT OPERATION OF RAW WATER SOURCES, Wisconsin Univ., Madison. Dept. of Civil Engineering; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineer-

For primary bibliographic entry see Field 04A. W71-08195

CHEBYSHEV **OPTIMAL** WASTE DISCHARGES,

Yale Univ., New Haven. For primary bibliographic entry see Field 05G. W71-08197

OPTIMUM DESIGN OF INTERBASIN TUNNEL SYSTEMS

Florida Univ., Gainesville. Dept. of Civil Engineer-

For primary bibliographic entry see Field 04A. W71-08198

WATER AND AIR IN REGIONAL PLANNING (IN GERMAN).

Water Resource Association of Northwest Switzer-

Schmassmann, Hansjorg (ed). Proceedings of the Third International Congress Pro Aqua, Basel Switzerland, 1965, Munich, R. Oldenbourg, 1967. 424 p, 166 fig.

Descriptors: *Water supply, Water pollution, Storage basin, Cost-benefit analysis, Regional analysis, Groundwater, Sewage disposal. Identifiers: *Iso-economic point, Subsidy, Trans-

This book contains the papers presented at the third International Congress PRO AQUA, 1965, in Basel, Switzerland, which dealt with problems of water and air in connection with regional planning. The larger part of the contributions concerns problems of water use and the planning of water use and the considers questions of problems of water use and the planning of water supply. A major section considers questions of water quality, supply, and allocation as related to power plants. In a second section, large area and long-term planning of drinking and industrial water supply are discussed, in particular the topics include, groundwater protection, water supply, and regional and interregional water distribution. The remaining sections treat technical aspects of water use, waste water disposal and purification. (See also W71-08261 and W71-08262) (Siegenthaler-Rutgers) W71-08260

THE ECONOMICS OF POLLUTION AND THE INTERDISCIPLINARY APPROACH TO ENVIRONMENTAL PLANNING,

Technische Hochschule, Darmstadt (West Germany).

Gerhard Kade.
International Social Science Journal, Vol XXII, No 4, p 563-575, 1970.

Descriptors: *Water pollution, Decision-making, Cost-benefit analysis, Resource Economic efficiency, Optimization. allocation.

Identifiers: *Environmental planning, Social cost, Externalities, Objective function.

Present methods of dealing with pollution and proposals of alternative strategy to environmental planning are considered. The author discusses traditional planning models and points out their inadequacies and implementation problems. The use of social costs and externalities in order to make an assessment of social loss attributable to air and water pollution is discussed. The author concludes the economist's use of taxes and subsidies as a solution to pollution is overly technological and neglects the social and political aspects of the problem. An interdisciplinary planning approach is presented to deal with environmental pollutants with the first step involving problem identification and the recognition of the interrelationship among and the recognition of the interrelationship among pollutants. The second phase deals with the organization of the planning process and finally the solution to the problem and means of implementation are considered. This planning approach is designed to bridge the gap between program formulation and implementators through the continual involvements of our internal papers in the continual involvements of our internal papers. tinual involvements of environmental planners in all phases of analysis. (Siegenthaler-Rutgers) W71-08264

APPLICATIONS OF MONTE-CARLO METHOD TO RESERVOIR DESIGN,

Institut fuer Wasserwirtschaft, Berlin (East Ger-

Siegfried Dyck, and Michael Schramm. In: Proceedings of the International Hydrology Symposium, Sept 6-8, 1967, Colorado State University. Fort Collins, Colorado, Colorado State University Press, p 406-413, 1967.

Field 06—WATER RESOURCES PLANNING

Group 6A—Techniques of Planning

Descriptors: *Monte Carlo method, Reservoir design, Correlation analysis, Gaging station, River flow, Regression analysis, Time series analysis. Identifiers: *Autocorrelation, Residual mass.

The Monte Carlo method is applied to storage problems or reservoir design. The authors generate time series of discharge which satisfy the observed laws of river flow as a prerequisite to the applica-tion of the Monte Carlo method. The method used tion of the Monte Carlo method. The method used to generate the time series is that proposed by Svanidze and is a three stage process. First, a series of mean annual river flow is generated followed by a series of annual hydrographs. Combination of the two time series is made and correlation analysis two time series is made and correlation analysis then applied. The results of the correlation analysis are a series of generated monthly river flows which enter into the Monte Carlo calculation. Using the same method, it is also possible to generate parallel series of river flow for a network of rivers. (See also W71-08265) (Siegenthaler-Rutgers)

ON THE PROCESS OF BUDGETING: AN EMPIRICAL STUDY OF CONGRESSIONAL AP-PROPRIATION, Carnegie Inst. of Tech., Pittsburgh, Pa

Otto A. Davis, M. A. H. Dempster, and Aaron

In: The Planning-Programming-Budgeting System Progress and Potentials, Washington, The US Government Printing Office, p 263-322, 1967.

Descriptors: *Government, *Budgets, *Resource allocation, Statistics, Decisionmaking, Model stu-

dies, Time, Social aspects.
Identifiers: *Non-defense agencies, *Linear
systems, Budget formation, Stochastic difference
equations, Estimating procedures.

A study is presented of the processes through which government's apportion funds between alterwhich government's apportion tunion between aler-native uses in allocating a significant portion of the country's resources. Simple laws are found, on the basis of statistical evidence, for the realized behavior of the process in at least half of the nondefense government agencies. For such agencies, certain linear systems of two stochastic difference equations are specified and fitted to time series data, with favorable results, suggesting that such systems accurately summarize certain aggregate outcomes of the budgeting process. Several models are presented, and their empirical results are analyzed in light of their limitations as alternatives in the decision making process. The criteria for determining a best specification for any agency from estimates of the alternative models is also considered. This article is valuable and relevant to the decision-making process involved in the budget formation for allocation of resources for water resource investment. (Murphy-Rutgers) W71-08272

EVALUATION MODELS FOR REGIONAL DEVELOPMENT PLANNING.

Iowa State Univ., Ames; Manitoba Univ., Win-nipeg; and Minnesota Univ., Minneapolis. Jerald Barnard, James MacMillan, and Wilbur Maki.

The Regional Science Association Papers, Vol 23, p 117-138, 1969.

Descriptors: *Regional analysis, *Model studies, *Natural resource development, *Economic analysis, Measurement, Input-output analysis, Capital, Government, Technology, Costs, Income, Investments.

Identifiers: *Evolution models, *Social accounts, *Development program, *Economic growth, Interlake area, Market, Human resources.

This paper presents an evaluation model for measuring the impact of a regional development plan in the Interlake Area of the Province of Manitoba, the object being to determine if maximum benefits have been gained from the funds spent. The Interlake Area's problems concerned the adjustment of natural resources and human and social capital to changing market and technological conditions. A federal-provincial regional development program was to be evaluated for efficacy in local resource development, occupational adjustments, reduction of costs, and improvement in both the quality and range of choice in public and private services. The evaluation process involves a system of social seevaluation process involves a system of social ac-counts which includes both current and capital accounts for business and government and provides a basis for developing a dynamic model of the econo-my. A dynamic mathematical account is formu-lated which simulates the area's growth over time to serve as a basis for measuring and evaluating the development plan programs. The proposed model is designed to facilitate understanding of the impact of alternative programs, to promote regional development, and to develop a regional growth model. This model should be of interest to water research concerned with the analysis and evaluation of the effect of water resource investments on a regional economy. (Murphy-Rutgers) W71-08277

SPECIFICATION REGIONAL **ECONOMETRIC MODELS**

Pennsylvania Univ., Philadelphia. Lawrence R. Klein.

The Regional Science Association Papers, Vol 23 p 105-115, 1969.

Descriptors: *Regional analysis, *Model studies, *Economic analysis, Income, Jobs, Rate of interest, Social aspects, Capital, Technology, Demand, Taxes, Prices.

Identifiers: *Econometrics, *Policy simulations, *Economic activity, Endogenous variables, Exogenous variables.

Econometric models generate regional variables of interest to state governments and businesses with limited market areas. The problem of industry models is presented as an analogous situation to the regional models in the discussion. The industry models selected are those of steel and automobiles. For each of these, the general structure of a plausible industry model is presented and endogenous and exogenous variables are delineated. It is then proposed that industries could be separately modeled in similar equation systems, which could then be linked consistently to a national aggregative model. Proposals for regional model building are similarly developed, and the static portions of the model relationships are specified in detail to support the concept of developing a particular model from a general one. Data requirements are discussed, and the drawbacks to the proposed method are juxtaposed with its advantages. This article is relevant to water research interested in analyzing the effects of water resource investment on a region as well as forecasting regional water demand. (Murphy-Rutgers)
W71-08278

APPLICABILITY AND LIMITATIONS IN THE USE OF NATIONAL INPUT-OUTPUT TABLES FOR REGIONAL STUDIES,

Cornell Univ., Ithaca, N.Y. Stanislaw Czamanski

Morgan Thomas (ed), The Regional Science Association Papers, Vol 23, p 65-77, 1969.

Descriptors: *Input-output analysis, *Regional analysis, *Model studies, Prices, Time, Demand, Economic analysis, Costs, Measurement, Data col-

Identifiers: *Washington State, *Case study model, Field survey, Primary industries, Imports.

Research is presented that is designed to develop and test a regional model by adjusting national input-putput co-efficients that would eliminate all or part of the differences due to price changes over time, degree of fabrication, composition of demand, industry mix, and structure of imports. The research also aimed at determining which sectors could be handled by short-cut methods without destroying the forecasting value, and which sectors

would require field study. The probable errors of would require field study. The probable errors of the case study model used were also analyzed, and compared with cost and time savings. The model used was a Washington State table, and the results indicated that the methods yielded acceptable results by considerably adjusting national inputoutput tables for purposes of regional studies. Such methods excluded tertiary sectors through aggregation and used field surveys to obtain input-output coefficients for primary industries and industries in which the regional economy is specialized. These results are relevant to the economic analysis of regional water resources problems. (Murphy-Rutgers) gers) W71-08279

MUTIPLIER-SOME REGIONAL PROBLEMS IN ESTIMATION, Glasgow Univ. (Scotland).

K. J. Allen.

In: Regional and Urban Studies, Beverly Hills, Sage Publication, 1969, p 80-96.

Descriptors: *Regional analysis, *Forecasting, *Economic analysis, Statistics, Costs, Income, Social aspects, Taxes, Government. Identifiers: Scotland, *Multipliers, Consumption patterns, Employment, Savings, Purchases, Regional leaks, Imports, Marginal propensities.

A discussion is presented of the meaning, uses, and importance of the regional multiplier in regional economics and policy. The paper is relevant to those areas of water resource analysis which demand a knowledge of the future of the regional economy in order to predict water demand. The topics treated are national and regional multipliers, the size of the multiplier, income and expenditure leaks, imports, and the use of marginal propensi-ties. As an illustration of the various concepts, a value is given to the Scottish regional multiplier based on the assumption that all production costs are labor costs. This assumption permits the esti-mation of the size of the mutiplier through an anal-ysis of Scottish consumption patterns. The results are then criticized for accuracy of calculations and comprehensiveness of analysis, and stress is given to the importance of the regional multiplier as an analytical and forecasting tool in economic policy making. (See also W71-08281) (Murphy-Rutgers) W71-08283

REGIONAL INPUT-OUTPUT ANALYSIS.

Glasgow Univ. (Scotland). Edith M. F. Thorne.

In: Regional and Urban Studies, Beverly Hills, Sage Publications, 1969, p 97-120.

scriptors: *Regional analysis, *Input-output analysis, *Planning, Statistics, Industrial production, Economic analysis, Technology, Income, Demand, Social aspects

Identifiers: Scotland, *Flow tables, National product, Buyers, Growth, Sales, Coefficients, Surpluses, Wealth.

An introduction is provided to the problems involved in the use of input-output analysis in regional planning. A simplified account of input-output analysis is described through use of input-output tables together with an analysis for a hypothetical economy. Regional analysis is discussed using this avalenation as hard-grant information as hard-grant information. this explanation as background information. For the regional aspect, a simple input-output model is presented, indicating the application of regional input-output analysis. The preparation of the input-output tables is discussed in some detail, as are the uses and limitations of such tables in regional economic planning. The benefits of the combination of theoretical and statistical factors that results from such analysis is indicated and the value of the resulting system of inter- and intra-regional linkresulting system of inter- and intua-regional integral ages is cited. The article is appended with a presentation of a Scottish regional input-output project that serves to illustrate the key concepts of the text. This article provides a valuable general explanation of regional planning analysis and may prove ap-

Evaluation Process—Group 6B

plicable in the area of regional water resource development. (See also W71-08281) (Murphy-Rutgers) W71-08284

MULTISTAGE ALLOCATION OF RESOURCES IN NATURAL PLANNING, New York Univ., N.Y.; and Alabama Univ., Hunt-

SVIIIC.

G. V. L. Narasimham, and Abbas Mirakhor.

Engineering Economists, Vol 16, No 2, p 103-116,

Jan-Feb 1971.

Descriptors: *Resource allocation, *Planning, *Maximization, *Economic analysis, Decision making, Input-output analysis, Optimization, Investment, Capital, Economic efficiency. Identifiers: *National planning, *Dynamic programming, *Maximum principle, *Economic development, Global optimality, Consumption, Scarcity.

Scarcity.

Studies were made of the difficulties of resource allocation in a multistage, two-sector national planning model and how discrete versions of dynamic programming and maximum principle can be applied to this problem. This problem of ascer-taining the optimum allocation of scarce resources to achieve stated goals is cited as the most crucial part of the operational research of economic development and planning. This problem of resource allocation in national planning is presented as an essentially sequential decision process, which has usually been dealt with by using process, which has usually been dealt with by using linear programming or input-output techniques. However, in this paper the techniques of the discrete versions of dynamic programming and the maximum principle are shown to be specifically designed for multistage decision processes, this making them especially suitable for resource allocation planning. The marks and should be seen that the state of the st cation planning. The merits and shortcomings of both techniques are shown, indicating that both methods are necessary to locate the global op-timum in problems such as nationally planned water resource allocation. (Murphy-Rutgers) W71-08297

6B. Evaluation Process

ALLOCATING WATER AMONG ALTERNA-

TIVE USES, Florida Univ., Gainesville.

J. E. Reynolds.

Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 97, No 1R1, p 85-92, Mar 1971.

Descriptors: *Allocation, *Economic efficiency, Costs, Optimization, Water demand, Profit, Projec-

Identifiers: *Alternative uses, *Economic criteria, Profit function, Marginal physical product, Marginal value product.

Relevant economic criteria for allocating water among alternative uses were examined in this paper. The approach was to consider first the increasing demands for water and then to examine economic criteria for allocating water and the interrelationships between economic, physical, and institutional considerations in making allocation decisions. To develop these economic criteria, assume that one of the goals of society is economic efficiency. Also assume that production functions can be estimated for all outputs. The production functions for different outputs and producers were expressed in general mathematical terminology. Profit was defined as the sum of the gross revenues for all producers minus the sum of the production costs of all producers. Profit maximization was derived by the partial derivatives of the profit function. The economic criteria presented should indicate the nature of the data needed for allocating water among alternative uses. (Wang-Rutgers) W71-07737 CONSUMER ASSESSMENT OF WATER QUALITY AND THE COST OF IMPROVEMENTS, California Univ., Berkeley. School of Public

Health.

For primary bibliographic entry see Field 05G. W71-07738

PLANNING FOR STAGED ECONOMIC DEVELOPMENT,

DEVELOPMENT,
Harza Engineering Co., Chicago, Ill. Resources
Development Branch.
K. E. Sorensen, and R. D. Jackson.
Journal of the Hydraulic Division, Proceedings of
American Society of Civil Engineers, Vol 94, No
HY5, p 1231-1244, Sept 1968. 9 fig, 2 ref.

Descriptors: *Planning, *Costs, *Benefits, Investment, Projects, Water development, *Evaluation. Identifiers: Staged development, Economic analysis, Criteria.

The engineering techniques and economic criteria for the planning and evaluation of staged development are discussed. The principal reasons for staged development are: evolving needs, limitations of investment capital, limitation of authorization, and limitations of basic data. Types of staged development include series of independent projects, series of interrelated projects, increment expansion of individual projects, planned obsolescence, and changes in project functions. Three principal economic factors which influence staged development are: (1) needs, goals, and benefit; (2) development are: (1) needs, goals, and benefit; (2) costs of water development; and (3) costs of non-water alternatives. The criteria that best suit analysis of staged development will relate to the rate of return on invested capital to the benefits achieved, or to the cost of alternative solutions. Two examples of economic analysis for staged development are given. It is a duty for the water resource planner to present a realistic evaluation of the economic merits of the water development and its alternations, as a guide to policy decisions. (Wang-Rutgers) W71-07746

ECONOMIC EVALUATION: ALTERNATIVES FOR INDUSTRIAL TREATMENT, Wichita State Univ., Kans.

For primary bibliographic entry see Field 05D. W71-07752

LTA Ltd., Johannesburg (South Africa). Henry Oliver.

Optima, Vol 20, No 2, p 58-67, June 1970. 4 fig, 6

Descriptors: *Water resources planning, *Multiple-purpose projects, *Water allocation (Policy), *Semiarid climates, *Dams, Hydroelectric power, Economic efficiency, Water users, Water costs, Evaporation, Irrigation practices, Irrigation efficiency, Planning, Consumptive uses, Industrial water, Effluents, Water quality control, Economic feasibility, Water consumption (Excludes consumptive use), Rainfall, Water assimulative capacity

Identifiers: *South Africa.

Historically, dams have been built for agricultural purposes, but modern pressures on water supplies are so intense and conflicting that the accent is cur-rently on inter-regional development requiring multipurpose dams. South Africa is a thirsty, semiarid region with low, sporadic rainfall and consistently high evaporation. Groundwater is limited and unreliable, but still provides supplies for 65% of the country's land area. Dam storage results in extremely high evaporation losses. Of all water-consuming sectors of the economy, agriculture is by far the greatest user. Due to limited river resources, lacking economics of scale and the need for great storage capacities because of environmental aridity, irrigation water development costs are extremely high. Surprisingly, this is not reflected in

user costs and there is no incentive to achieve efficiencies in use. It is suggested that yields relative to development costs and water losses make arid development costs and water losses make arid lands irrigation developments impractical and that more attention should be given to irrigation projects which would stabilize and increase production in humid regions. Consumptive use criteria in planning river basin development in dry regions are inadequate and more attention should be focused on water rehabilitation. South African industrial use is much greater than statistics indicate because of the consumptive effects of effluent discharge. This must be ameliorated by better recycling and effluent elimination practices. Water price structures for industries and municipalities are also too tures for industries and municipalities are also too low and should be reexamined. Ultimately water costs may exceed both price and value if the status quo is blindly maintained. (Casey-Arizona) W71-07807

HUMAN RESPONSE TO RECURRENT DROUGHT IN NORTHEASTERN BRAZIL, Colorado Univ., Boulder.

R. H. Brooks.

Professional Geographer, Vol 23, No 1, p 40-44, Jan 1971. 2 fig, 18 ref.

Descriptors: *Droughts, *Social impact, *Political aspects, *Economic impact, History, Water storage, Rainfall, Migration, Crop response, storage, Rainfall, Semiarid climates. Identifiers: *Starvation, *Northeastern Brazil.

The heavily populated semiarid northeastern region of Brazil has 2 seasons, a rainy winter and a dry summer. The population is composed mainly of unskilled laborers and peasants living at poverty levels and sustained by a semimarginal agriculture which is dependent upon the winter rains. These rains are not dependable as evidenced by a record of 36 droughts lasting 1-5 years between 1603 to 1958. The social results are calamitous. An estimated 2 million people did not results are calamitous. An estimated 2 million people did not results are calamitous. mated 2 million people died as a result of drought factors from 1877 to 1919. As a drought progresses, food supplies diminish, cattle herds starve and food prices progressively increase. In extended famines the people have eaten any animals or plants available, cooked or raw. Human or plants available, cooked or raw. Human physiological deterioration has in turn led to unchecked epidemics. The major sociological consequence has been in 2 forms of migration: micromigration, mainly from rural areas to villages and urban areas, and macromigration, which is mass flight to other parts of Brazil. Governmental responses in the past have been mainly characterized by unpresendance and hole to consequence. terized by unpreparedness and lack of concern, although some belated forms of assistance did occur. The author feels that these recurrent calamitics require a major governmental assistance program, and there are indications that such a program is finally being developed. (Casey-Arizona) W71-07814

WATER RESOURCES AND IRRIGATION DEVELOPMENT IN THE MIDDLE EAST, Keble Coll., Oxford (England). Dept. of Geog-

For primary bibliographic entry see Field 03F. W71-07822

RETURNS FROM DRYLAND FARMING IN THE TRIANGLE, Montana Agricultural Experiment Station,

Bozeman. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 03F.
W71-07823

A PERSPECTIVE OF CONTEMPORARY WATER PLANNING AND MANAGEMENT PROBLEMS IN UTAH,

Utah Water Research Lab., Logan.

Originally presented at the 7th Annual Engineering Symposium, Brigham Young University, Apr 16,

Group 6B—Evaluation Process

1966. Occasional Paper 3, Aug 1969. 26 p, 5 fig, 1 tab.

Descriptors: *Utah, *Inter-basin transfers, *Semiarid climates, *Water resources development, *Planning, Social aspects, Legal aspects, Political aspects, Geographical regions, Economic Costibility, Puroff, Preprint Par feasibility, Runoff, Precipitation (Atmospheric), Consumptive uses, Water consumption, Phreatophytes, Evaporation, River basins, Water conservation, Colorado River Compact, Water management (Applied).

Identifiers: *Central Utah Project, Central Arizona

Approximately 15% of the total annual rainfall of Utah, or 9 million acre-feet, becomes stream flow runoff. This amounts to 8,000 gallons per person per day, yet Utah is considered a chronically watershort state. Hydrologically, the state is divided into 3 basins, the Columbia (1% total runoff) the Great Basin (57%) and the Colorado (42%). The ap-Basin (57%) and the Colorado (42%). The apparent water shortage arises from 2 phenomena: (1) over 2/3 of the water is consumed by phreatophytes and evaporation (2) about 57% of Utah's water yield comes from Great Basin drainage while about 85% of water consumption occurs there, and only 15% in the Colorado River Basin, indicating a maldistribution of resources. Of 1.9 million acre-feet available to the state in interestate waters only 579,000 acre-feet are Cur-1.9 million acre-teet available to the state in in-terstate waters, only 579,000 acre-feet are cur-rently used, leaving the rest to flow downstream in the Colorado River, or into Great Salt Lake from the Bear River. Additionally, many circumstances indicate future reductions in Utah's share of Colorado River waters, while demand projections indicate greater future needs for Colorado River water than the state's present allocation. The Central Utah Project is in the planning stages, and will involve a transbasin transport from the Vintah mountains, for municipal consumption purposes, into the heavily populated Bonneville Basin. It is argued that this is unrealistic since it will involve mil-lions of dollars spent in planning to import water into an area which, from a hydrologic viewpoint, already has a water surplus. Instead, an effort must be made to overcome the political power of the norther region and move water into southern underpopulated parts of the state. The development alternative of spreading rather than concentrating water makes much more economic sense. (Casey Arizona) W71-07825

RESOURCES, COSTS AND RETURNS ON CAT-TLE RANCHÉS IN THE MOUNTAIN AREAS OF COLORADO BY SIZE OF RANCH.

Colorado State Univ., Fort Collins. Dept. of Economics.

For primary bibliographic entry see Field 03F. W71-07829

INSTITUTIONAL DESIGN FOR WATER QUALITY MANAGEMENT: A CASE STUDY OF THE WISCONSIN RIVER, VOL I, SECTION A -

SUMMARY, Wisconsin Univ., Madison. Water Resources

For primary bibliographic entry see Field 05G. W71-07972

WATER RESOURCES RESEARCH INVENTO-RY - 1969.

Department of National Development, Canberra (Australia).

For primary bibliographic entry see Field 09A. W71-08093

A STORM DRAINAGE AND OPEN SPACE MASTER PLAN FOR HAMILTON COUNTY,

Consoer, Townsend and Associates, Chicago, III. For primary bibliographic entry see Field 04A. W71-08122

WATER IN THE DESERTS, . Utah State Univ., Logan. Coll. of Engineering. Dean F. Peterson.

Presented at an international conference 'Arid Lands in a Changing World,' Tucson, Arizona, June 1968. In: Arid Lands in Transition, Dregne, Harold E. (ed), p 15-30, Publication No 90, AAAS, 1970. 1 fig, 2 tab, 34 ref.

Descriptors: *Arid lands, Water resources development, *Social aspects, *Water users, Rainfall, Groundwater, River basins, Ecology, Deserts, Environmental effects, Groundwater recharge, Foreign countries, Ecosystems, Grazing, Food habits, Geographical regions, Irrigation practices, Experience of the Property Salinity Irrigation effects, Irrigation systems, Salinity, Hydroelectric power, Navigation, Floods. Identifiers: *Developing nations, *Technological effects, Ecological impact, *Oases, *Waterlogging.

In assessing the impact of man's exploding technology in dealing with desert water problems, desert water sources are briefly reviewed and methods of their utilization discussed. River types occurring in deserts ranged from low temporary to high perennial flows, in many areas, variously ex-ploited by man for millennia. Groundwater is al-ways an important water source of varying quality ways an important water source of varying quality and such supplies may range from recently recharged reservoirs to the mining of fossil sources. Deserts are fragile ecosystems. Man's social structure is strongly influenced by his degree of adaptation, but this leads to the problem that the more he conquers his desert, the less the adaptation required but the greater the ensuing ecological disruption. In food gathering and hunting societies, which either directly or indirectly harvest the scant desert vegetation, social units are small wide-range. desert vegetation, social units are small wide-rangdesert vegetation, social units are small wide-rang-ing ones having no major impact on desert ecology. Grazing societies, whether pastoral nomad or cow-boy and sheepherder, also range over wide areas, but may wreak great ecological destruction through mismanaged overgrazing. Where scattered oases occur, an oasis agriculture may develop. This type of agriculture may be sustained by tapping groundwater supplies or by the creation of irrigation canals (such as Afghanistan's qanats). Modern technology has given rise to large-scale irrigation schemes involving local supplies or interbasin transfers. The problems arising from these schemes, particularly waterlogging and salinity, are discussed. It is maintained that alternatives must include adaptation as well as exploitation, including population control (Cascy-Arizona) W71-08134

AGRICULTURAL PRODUCTION IN IR-RIGATED AREAS,

Utah State Univ., Logan.

For primary bibliographic entry see Field 03F. W71-08137

ECONOMICS OF LAND AND WATER USE,

New Mexico Univ., Albuquerque. Dept. of Economics.

Nathaniel Wollman.

Presented at an international Conference, 'Arid Lands in a Changing World', Tucson, Arizona, June 1969. In: Arid Lands In Transition, Dregne, H E (ed), Pub No 90, AAAS, p 143-163, 1970. 1 tab, 1 fig, 18 ref.

Descriptors: *Arid lands, *Economic feasibility, *Cost-benefit analyses, *Water utilization, *Competing uses, Economic prediction, Diversion, Effi-ciencies, Social aspects, Water policy, Water costs, Water users, Marginal productivity, Model studies, Land uses.

Identifiers: *Developing nations.

A formal economic model is developed, with simplified assumptions, for utilization of land-water resources, using alternative optimizing guides. Since overpopulation and illiteracy are contributing factors to poverty, it has been no means clear that aridity per se causes low per-capita incomes. A recent study of 39 countries indicated that no significant difference could be found between

semiarid and arid countries with reference to either semiarid and arid countries with reference to either gross domestic products or growth rates. This situation is emphasized by widespread water wastage in both developed and undeveloped arid nations. Many underdeveloped countries are unable to efficiently utilize modern inputs into agriculture because of insufficient education, and irrigated land is therefore not a limiting factor. A related problem, particularly in developed countries such as the U.S. and Israel, is the desirability of devoting water to agriculture when there is demand for its in water to agriculture when there is demand for it in alternative uses such as manufacturing or mining. After examining the costs of new water from several possible sources, it is concluded, with reservations, that when alternatives to agriculture are available they are usually preferable. Such projects as water diversion into the Colorado Basin for agriculture are considered economically unrealistic. Education is considered, together with water resource development, as important factors in the growth of many arid lands. However, even large development schemes, such as the Aswan Dam, have small effects on per capita income in heavily populated countries. (Casey-Arizona) W71-08138

ROLE OF SOCIAL SCIENCE IN LAND AND

WATER UTILIZATION,
Massachusetts Univ., Amherst. Dept.

Anthropology. Richard B. Woodbury.

anthropology, *Social Sciences.

Presented at an international conference, 'Arid Lands in a Changind World', Arizona, June 1969. In Arid Lands In: Transition, Dregne, H E (ed), Pub No 90, AAAS, p 175-189, 1970. 30 ref.

Descriptors: *Social values, *Social impact, *Political aspects, *Land use, *Water utilization, Arid lands, Planning, Decision making, Social aspects, Evaluation, Economics, Behavior, Social mobility, Social needs, Technology, Ecology, Semiarid climates, Geographical regions. Identifiers: *Human *Cultural ecology,

In planning problems involving technological innovations, the social scientists have traditionally deferred to engineers, thus diminishing their influence in the planning of such practical matters as water systems, and in the evaluation of human ecological problems. Examples associated with the Aswan High Dam and Lake Kariba are cited. Investigations in human and cultural ecology must consider historical successions of adaptive economics and the dislocations of various adaptive and behavioral modes wrought by technological change. A cultural ecological study of farm people in the semiarid plains of Saskatchewan yields some unsettling results for arid and semiarid regions in general. Perception is another critical area, not only for planners and politicians handicapped by limitations but also for those more immediately concerned. The example of widely varying perceptions of drought by the plains farmers is cited. Government agencies are prone to disagreement in matters involving evaluations based on perceptions. The author maintains that we can no longer afford to develop arid regions on humid region criteria. New approaches must be developed through the cooperation of physical and social scientists. (Casey-Arizona) W71-08150

INTERNATIONAL SYMPOSIUM ON COMPUTER CONTROL OF NATURAL RESOURCES AND PUBLIC SERVICES,

Office of Naval Research, London (England). Immanuel Estermann.

Available from the National Technical Information Service as AD-823 612, \$3.00 in paper copy, \$0.95 in microfiche. ONRL Conference Report C-17-67, 23 Oct 1967, 13 p.

Descriptors: *Water supply, *Power plants, *Natural resources, Oil industry, Control systems. Identifiers: Israel, Data processing systems.

Evaluation Process—Group 6B

The technical program dealt with: water supply, oil refineries, power stations, vehicular traffic, and telephone systems. Selected papers are reviewed in detail in this report. An appendix lists all papers W71-08166

FEASIBILITY STUDY OF WATER IMPOUND-MENTS, MESCALERO APACHE INDIAN RESERVATION, SOUTH CENTRAL NEW MEX-ICO.

Boyle Engineering, Ventura, Calif.

Available from the National Technical Information Service as COM 7100168, \$3.00 in paper copy, \$0.95 in microfiche. Economic Development Administration Technical Assistance Study, Dec

Descriptors: *Reservoirs, Reservoir sites, Recreation facilities, Economic impact, Damsites, New Mexico, Tourism, Cost analysis.

Identifiers: Economic development, Skiing, Sites, Fishing, Economic conditions, Feasibility, Mescalero, Apache Indian Reservation, *Indian reservations, Cienegita Creek, Campsites.

The study describes six dam sites in terms of their possible use to create water impoundment for recreation. Three are recommended as best for immediate development in terms of reliability of water supplies. Geological hydrologic findings are presented in text and charts. Benefits from tourist use of the facilities are forecast in terms of reservoirs to serve lodges in scenic and ski areas, camping sites, and use for stockwater and for fishing. The creation capability of the water impoundment projects are part of the Mescalero Apache Tribe's long-range plans for developing recreation for public use on their reservation.
W71-08172

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM, Fresno County Planning Dept., Calif.

For primary bibliographic entry see Field 05G.

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE. VOLUME 1, SUMMARY SUP-

Fresno County Planning Dept., Calif.

Available from the National Technical Information Service as PB-197 502, \$3.00 in paper copy, \$0.95 in microfiche. Fresno County Planning Dept Report, Mar 1970. 115 p, 33 tab, 22 fig. HUD Grant.

Descriptors: *California.
Identifiers: *Regional planning, *Water supply, Regional planning, *Waste disposal, Sewers, Public health, Water quality, Groundwater, Project planning, Water quality, Groundwater, Project planning, Urban development, Economic factors, Water reclamation, Industrial wastes, Sewage treatment, Mathematical models, *Fresno County (Calif).

The five volume publication proposes solutions to water supply and liquid waste disposal in a 410 square-mile area of Fresno County, California, encompassing the cities of Clovis, Fowler, Fresno, Kingsburg, and Selma, plus intervening unincorporated portions of the County. The report recommends facilities required to satisfy projected needs during short-range (1975), mid-range (1985), and long-range (2015) periods. (See also W71-08179) W71-08178

CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM. VOLUME V. MATHEMATICAL MODEL FOR GROUND-WATER.

Fresno County Planning Dept., Calif.

Available from the National Technical Information Service as PB-197 506, \$3.00 in paper copy, \$0.95 in microfiche. Fresno County Planning Dept Re-port, July 1970. 86 p, 6 tab, 45 fig, 14 ref. HUD Grant.

Descriptors: *California.
Identifiers: *Regional planning, *Water supply, Regional planning, *Waste disposal, Mathematical models, Sewers, Public health, Water quality, Groundwater, Project planning, Urban development, Economic factors, Water reclamation, Industrial Security of the Presson County. trial wastes, Sewage treatment, *Fresno County

The primary objective of the Water and Liquid Waste Program for the Central Fresno County Urbanizing Area has been to develop short-, medium-, and long-range programs for providing water supply and sewerage facilities from 1970 to 2015. A major emphasis of the study has been related to the protection of public health and the maintenance of groundwater quality and quantity in fu-ture years. (See also W71-08178) W71-08179

LAND CONDITIONS AND NATURAL RESOURCES, EXISTING LAND USE, A. B. C. D. REGIONAL PLAN, PHASE I. Mo-Kan Bi-State Planning Commission, St. Joseph.

Available from the National Technical Information Service as PB-196 836, \$3.00 in paper copy, \$0.95 in microfiche. Mo-Kan Bi-State Plan Report, Oct 1970. 112 p. HUD Project Missouri P-153

*Land development, *Natural Descriptors: *Land development, *Natural resources, *Planning, Land use, *Recreation facilities, Soil types, Environmental engineering, Vegetation, Climatology, Geology. Identifiers: Regional planning, *Andrew County Missouri, *Buchanan County Missouri, *Clinton County Missouri, *DeKalb County Missouri.

The document contains a basic study of the Missouri-Kansas region, preparatory to the development of a future land use allocation plan. The study includes a review of the earth resources in the area; the historical climatical conditions; geology, topog-

raphy and soils in the Region. In addition, water

sources are inventoried on a general basis.

REGIONAL AND INTERREGIONAL PLANS FOR WATER DISTRIBUTION (IN FRENCH). Bureau of Water Protection, Neuchatel (Switzer-

land).

Proceedings of the Third International Congress Pro Aqua, Basel, Switzerland, 1965. Munich, R. Oldenbourg, p 224-244, 1967.

Descriptors: *Water supply, Regional planning, Water demand, Water pollution, Capital investment.

Identifiers: *Subsidy, Recycling, Interregional planning, Transportation cost.

The problem of water distribution at the regional and interregional levels are considered. Since natural water supplies in regional areas are generally insufficient, the regional water supply must be conveyed by artificial means to compensate for seasonal fluctuations. Interregional water supply systems require high transportation costs for the conveyance of water supply as well as investment in supply equipment. The result is that the price of water increases. The author suggests that subsidies from the state may be necessary to cover part of the investment, thereby avoiding excessive pay-off rates. Subsidies are especially relevant for rural areas where the financial yield of the water supply is low. The future indicates that increased scarcity and pollution will necessitate industrial recycling of water supply. (Siegenthaler-Rutgers) W71-08262

EFFECT OF WATER RESOURCE INVESTMENT ON ECONOMIC GROWTH,

Economic Research Service, Upper Darby, Pa.; and Franklin Inst. Research Labs., Philadelphia, Pa.; and Temple Univ., Philadelphia, Pa. P. Thomas P. Cox, C. Wilford Grover, and Bernard

Water Resources Research, Vol 7, No 1, p 32-38, Feb 1971.

Descriptors: *Water resource development, Economic evaluation, Regression analysis, Hydrology.

rydrology. Identifiers: *Economic growth, Discriminant analysis, Growth index, Socioeconomic indicator, Principal component analysis.

An analysis was made of the effect of water resource development projects on the economic growth of small regions. Counties in the Northeastern United States in which large water resource development projects were constructed between 1948 and 1958 were studied to determine whether the projects did stimulate economic growth. An index of growth composed of fifteen variables was used as a dependent variable and tested for its relationship with other independent variables using stepwise regression and discriminant analysis techniques. The results indicated there was no relationship between project size and economic growth and the selection of project sites was biased toward urban areas where there is a greater likelihood of economic growth. The authors conclude that it is dubious whether water resource projects serve as a stimulus to economic growth for the strictly rural counties tested for the northeastern United States. (Siegenthaler-Rutgers) W71-08263

INTERNATIONAL HYDROLOGY SYMPOSIUM,

Colorado State Univ., Fort Collins.

Vujica Yevjevich.

Proceedings, The International Hydrology Symposium, Sept 6-8, 1967, Colorado State University. Fort Collins, Colorado State University Press, 1967, 671 p.

Descriptors: *Hydrology, Flood control, Probability, Water balance, Forecasting, Streamflow, Monte

Identifiers: *Skewness, Parametric statistics.

This book presents the papers delivered at the International Hydrology Symposium held at Colorado State University, September 6-8, 1967. One of the objectives of the symposium was to stimulate new scientific ideas and advance research methods in hydrology. The main subjects considered were new models for parametric, dynamic, physical or analytical hydrology and the applica-tion of statistical methods from the physical and so-cial sciences to the study of hydrology. Models dealing with flood forecasting, reservoir design, and streamflow were also presented at the symposium. (See also W71-08266 thru W71-08268) (Siegenthaler-Rutgers) W71-08265

A STOCHASTIC APPROACH TO THE DEVELOPMENT OF A REGULATION PLAN FOR THE GREAT LAKES,

Department of Energy, Mines and Resources, Ottawa (Ontario); and McGill Univ., Montrel

R. H. Clark, and G. S. Cavadias.

In: Proceedings of the International Hydrology Symposium, Sept 6-8, 1967, Colorado State University. Fort Collins, Colorado, Colorado State University Press, p 430-442, 1967.

Descriptors: *Regulation plan, Stochastic processes, Hydrology, Uncertainty, Decision-making, Water supply, Simulation analysis, Optimization, Probability distribution.

Identifiers: *Objective function, Autocorrelation,

Clustering, Rule curve.

Field 06-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

A stochastic approach to the regulation of the Great Lakes water levels and flows is presented. The hydrologic conditions of the Great Lakes have economic implications because competing uses including water supply, power development, and shore property interests. The regulation plan is considered as a sequence of decisions under uncertainty with the testing record generated by a stochastic process. The nature of this process is estimated from the historical record and the regulation plan is based on minimizing the probability of non-attainment of criteria developed from economic, technical, and social considerations. A multivariate model was used in the simulation analysis and the sequence generated were subjected to statistical tests such as clustering, frequencies, and autocorrelation to verify whether the properties of the recorded supplies were conserved. (See also W71-08265) (Siegenthaler-Rutgers)

ON THE APPROPRIATE DISCOUNT RATE FOR EVALUATION OF PUBLIC PROJECTS,

Princeton Univ., N.J. William J. Baumol.

In: The Planning-Programming-Budgeting System: Progress and Potentials, Washington, U.S. Government Printing Office, p 152-159, 1967.

Descriptors: *Rate of discount, *Economic efficiency, *Resource allocation, *Government, Investment, Capital, Risk, Economic analysis, Costbenefit analysis, Government supports, Welfare economics.

Identifiers: *Opportunity costs, Private alternatives, Yield, Irreplaceable resources.

Various ramifications of ascertaining an appropriate discount rate for the evaluation of public projects are discussed. The significance of the discount rate is dealt with, and opportunity cost is presented as the basic criterion for the choice of the discount rate based on an economic analysis of the uses of cost-benefit principles. The importance of the discount rate is stressed, since at stake is the allocation of resources between the private and public sectors of the economy. Several other factors are dealt with in some detail, including the opportunity cost of consumer resources, the discount rate on resources from the business sector, the changes in rates on government bonds, the calculation of the rate of return on long-term bonds, and the future subsidy issue. A discount rate of no lower than 4.75 percent is proposed by the author to avoid misallocation of resources and economic inefficiencies. This article is particularly relevant for the allocation and evaluation of water resource investment. (Murphy-Rutgers)

DISCOUNT/INTEREST RATES IN EVALUA-TION OF PUBLIC INVESTMENT PROJECTS, Banks (R.L.) and Associates, Washington, D.C. Robort L. Banks.

In: The Planning-Programming-Budgeting System: Progress and Potentials, Washington, U.S. Government Printing Office, p 237-242, 1967.

Descriptors: *Investment, *Cost, *Government, *Economic efficiency, *Interest rate, *Water resource development, Rate of discount, Cost benefit analysis, Taxes, Time, Resource allocation, Social aspects, Budgets, Planning, Profit. Identifiers: *Opportunity cost, Cost effectiveness, Social cost, Programming.

The question is discussed of the appropriate discount rate to be used in assessing the economic feasibility of government investment, particularly water resource projects. The presentation includes a brief historical background, the critical role of discount/interest rates in benefit-cost calculation, and an evaluation of the appropriate interest/discount rate. The social goal of government projects is stressed, and it is indicated that usually this principal goal will be the achievement of optimal allocation of scarce resources, rather than

other purposes which can be achieved only at the expense of economic efficiency. To avoid distortions in the benefit/cost calculations to achieve these goals, the author proposes utilizing the opportunity cost principle in calculating the appropriate interest/discount rate. The use of a lower rate is incompatible with political and social philosophy, as well as economically indefensible in government water resource investment. (Murphy-Rutgers)

PROGRAM BUDGETING IN WISCONSIN,

Wisconsin, Legislature's Joint Committee on Finance, Madison.

John W. Reynolds, and Walter G. Hollander.

John W. Reynolds, and Walter G. Hollander. In: The Planning-Programming-Budgeting System: Progress and Potentials, Washington, The US Government Printing Office, p 243-248, 1967.

Descriptors: *Decisionmaking, *Budgets, *Government, Costs, Economic efficiency, Planning, Economic analysis, Financing, Evaluation.

Identifiers: *Program budget, *Policy-making, Wisconsin, Review process, Program goals, Subprograms.

The revised program budgeting system in Wisconsin is presented as an example of the efficient operation of a system based on systematic techniques for planning, reviewing, modifying and carrying out government programs. Program budgeting is defined and developed along with the underlying considerations of the program and the key factors for success. The program budget format is broken down into sub-programs, which permit review for relative accomplishment. The expected results include budget preparation on the basis of expected results, upgrading of the budget decision-making process, and substantial improvement in the ease of public comprehension and appraisal of responsible government. This proposal for effective overhaul of the government budget process has relevance for government investment in public works projects, including those in water resources. (Murphy-Rutgers)

EXTRACTIVE RESOURCES AND TAXATION, Wisconsin Univ., Madison.

Mason Gaffney (ed), Madison, University of Wisconsin Press, 1967. 450 p.

Descriptors: *Natural resources, *Taxes, *Government, *Optimization, Economic analysis, Risk, Fisheries, Natural resource development, Social aspects, Economic efficiency.

Identifiers: *Extractive resources, *Resource policy, Exhaustibility, Resource exploitation, Oil, Timber, Distribution.

This book presents the various proceedings of a symposium on extractive resources and taxation sponsored by the Committee on Taxation, Resources and Economic Development at the University of Wisconsin. Exhaustible resources and their taxation are treated as important links in the development of economic and fiscal theory and policy, the use of taxation being the assertion of public interest in the natural resources. The various articles included in the book appear in a manner designed to present all aspects of taxation of natural resources, and to advance proposals for such taxation under conditions of exhaustibility. The book divides the problem into overlapping areas of economic theory, economic institutions and economic policy which deal with such problems as resource depletion, resource exploitation, resource control, natural resource allocation, distribution and taxation. These topics are of special interest to research in water resource development. (See also W71-08274 thru W71-08275) (Murphy-Rutgers) W71-08273

ECONOMIC THEORY AND RESOURCE POL-

ICY, Purdue Univ., Lafayette, Ind.

Irving Morrissett.
In: Extractive Resources and Taxation, Madison,
The University of Wisconsin Press, p 295-314,
1967.

Descriptors: *Natural resources, *Economic analysis, *Resource allocation, *Planning, Prices, Time, Government, Costs, Marginal cost, Taxes, Benefits, Social aspects, Income, Welfare economics. Identifiers: *Public planning, Subsidies, Externalities, Cartelization, Market system, Competition,

A broad public policy for exhaustible resources is presented in the setting of a policy for all natural resources. Particular attention is given to the role of controls, taxes, and subsidies in supplementing the price system. Price theory, competition theory, and welfare theory are also utilized in the discussion. Several means are suggested to modify and supplement the operations of the imperfectly competitive market system of natural resources. Included in the remedies proposed are increased discussion and research on the social goals of an economy, taxation on the value of resources, development of a technically feasible appropriating unit for natural resources, and better measurement of cartelization externalities of production. Further suggestions include avoidance of resource industries, use of long-run marginal cost as a basis for pricing all resources, use of justifiable subsidies to growth, and restriction of the time horizon in planning for public uses of natural resources. These points are relevant to all natural resources planning areas, including water resources. (See also W71-08274) (Murphy-Rutgers)

OPTIMIZATION AND TAXATION IN AN OPEN-ACCESS RESOURCE: THE FISHERY, Columbia Univ., New York. Graduate School of

Giulio Pontecorvo.

In: Extractive Resources and Taxation, Madison, The University of Wisconsin Press, p 157-167, 1967.

Descriptors: *Optimization, *Taxes, *Fisheries, *Government, *Resource allocation, Economic analysis, Population, Economic efficiency, Model studies, Price, Fish protein, Benefits, Income. Identifiers: *Maximum physical yield, Market mechanism, Treaties, Constraints, Welfare, Instability, Valuation.

This article discusses the economic theory of fisheries, considering fisheries as a case where the market mechanism under normal (i.e. competitive) conditions fails to provide the proper allocation of resources. The problems associated with the accepted optimum of maximum physical yield are surveyed and the recent models integrating biological yield functions with economic conditions of production are presented. The various difficulties of these models are also discussed, particularly in light of their effect on fishing treaties. Recent theoretical developments of the fishing optimization problems are presented, with particular attencing given to the structural issues of instability and valuation. The conditions under which a developed fishery will provide a positive net economic yield are delineated and various taxation difficulties are discussed in relation to these conditions. Alternative means of taxation and valuation to reach the optimal goal are suggested in addition to methods of selecting the best means for a particular fishery. (See also W71-08273) (Murphy-Rutgers) W71-08275

PROFESSIONAL DECISION-MAKING,

Rand Corp., Santa Monica, Calif. James R. Miller. New York, Praeger, 1970, 305 p.

Evaluation Process—Group 6B

Descriptors: *Decision-making, Operations research, Systems analysis, Optimization, Risk, Economic evaluation, Resource constraint, Cost. Identifiers: *Worth assessment, Sensitivity analysis, Net worth, Cardinal utility, Capital budgeting.

This book considers the subjective part of decision-making, worth assessment, and decision-making processes. Worth assessment is outlined as a systematized procedure rather than subjective process through the use of the concept of an assessment structure. Operations research, decision-theory, and systems analysis is used to derive the assessand systems analysis is used to derive the assess-ment structure. An experiment was performed to validate the assessment procedure and to deter-mine whether professional decision-makers were able to achieve successful implementation. The procedure was empirically validated. The resulting worth assessment is integrated with resource con-straints to arrive at a final decision using a decision rule that chooses the most feasible alternative with the highest worth score. The decision procedure is extended via sensitivity analysis to generate compound alternatives or include uncertainty. This book is relevant to water research concerned with decision making processes. (Siegenthaler-Rutgers) W71-08276

REGIONAL AND URBAN STUDIES,

Birmingham Univ. (England); and Glasgow Univ. (Scotland).

J. B. Cullingworth, and S. C. Orr.
Beverly Hills, Sage Publications, 1969. 282 p.

Descriptors: *Regional analysis, *Planning, *Natural resource development, Cost-benefit analysis, ral resource development, Cost-benefit analysis, Population, Transportation, Economic analysis, Social aspects, Jobs, Decisionmaking, Input-output analysis, Data collection. Identifiers: *Resource use, *Social scientists, *Economic development, Inter-disciplinary approach, Regional multiplier, Economic potential.

This book is a selection of articles representing the participation of social scientists in regional and urban studies. Issues discussed include regional economic planning and its limitations, the techniques and complexities of labor market analy-sis, and the problems involved in estimating the regional multiplier. Other concepts dealt with include population projection, housing analysis, economics of urban transport and employment projections. Finally, a case study of comprehensive urban renewal and industrial relocation in Glasgow is presented to indicate the interdependency of economic factors and planning decisions which has been stressed throughout the various articles in the volume. Practically all articles express dissatisfacvolume. Practically ail articles express dissatisfaction with techniques in use, and propose changes and/or areas for further study. Since the book represents a study of how to make the best use of regional resources, thus achieving the desired goal of economic growth in regional development projects, it should be of interest to water research evaluating impact of regional water projects. (See also W71-08282 thru W71-08285) (Murphy-Rutgers) W71-08281

PARTICIPATION OF SOCIAL SCIENTISTS IN PLANNING--A BACKGROUND TO THE STU-

Birmingham Univ. (England); and Glasgow Univ. (Scotland).

J. B. Cullingworth, and S. C. Orr.
In: Regional and Urban Studies, Beverly Hills, Sage
Publications, 1969, p 1-19.

Descriptors: *Planning, *Economic analysis, *Cost benefit analysis, *Regional analysis, Government, Population, Transportation, Costs, Social aspects, Rate of interest, Jobs, Uncertainties, Spillover, Identifiers: *Economic growth, *Economic development, *Social scientists, Fiscal policy, Ex-

A general survey is presented of social science approaches to planning problems in British regional and urban studies. A brief historical development of social scientists' participation in such planning is presented and contrasted with recent planning and planning thought, which is arbitrarily assumed to be post-1960. Particular attention is given to the dissatisfaction of pre-1960 planning and the need for the development of economic planning to deal with specific difficulties, such as those caused by population overspill, and innovative transportation techniques. Special attention is given to the relationship between the goal of growth and the development of under-utilized resources through public expenditure. The change in scope from urban to regional boundaries is also discussed in some detail. This article is relevant to research interested in the relationship of water resource development to regional economic growth. (See also W71-08281) (Murphy-Rutgers) W71-08282

SANITARY SEWER COLLECTION SYSTEMS,

Department of Housing and Urban Development, Washington, D.C.

For primary bibliographic entry see Field 05D. W71-08286

CAPITAL BUDGETING, A QUANTITATIVE EVALUATION OF INVESTMENT ALTERNATIVES,

Stanford Univ., Calif.
Robert V. Oakford.
New York, The Ronald Press, 1970. 276 p.

Descriptors: *Economic evaluation, Decision-making, Probability theory, Cost-benefit analysis, Risk, Budget constraint, Random variable.

Identifiers: *Capital budgeting, Sensitivity analysis, Present worth, Cash flow.

This book presents a discussion of capital budgeting, emphasizing the quantitative measures used in ing, emphasizing the quantitative measures used in evaluating investment alternatives. The author defines the classical measures of worth: present worth, cost-benefit ratio, growth rate and cash flow and then discusses their relative strengths and weaknesses. Problem situations where decisionmaking occurs under conditions of uncertainty are considered along with the analysis of the criteria to be used in project evaluation. Sensitivity analysis is used to deal with uncertainty. Another approach used is the expression of uncertainty in terms of random variables, a method based on probability theory. Benefits and costs of prospective projects also are expressed as random variables for the decision-making process. This book is relevant to water research involved in capital budgeting decisions and project evaluation (Siegenthaler-Rutgers) selection. and W71-08289

WATER, EARTH, AND MAN.

Cambridge Univ. (England).

Richard J. Chorley, ed. London, Methuen and Co., Ltd., 1969. 588 p.

Descriptors: *Hydrology, *Resource allocation, Cost-benefit analysis, Budget constraint, Systems analysis, Evapotranspiration, Surface runoff,

Groundwater, Flood control. Identifiers: *Water resource systems, Objective function, Opportunity cost, Capital cost.

This book presents a series of essays concerned with the theme that the study of water provides a logical link between an understanding of physical and social environments. Each chapter develops this theme by proceeding from the many aspects of water occurrence to a deeper understanding of natural environments and their fusion with the activities of man in society. Water is viewed not only as a commodity used by man but also as the mainspring for economic development and also a formative factor in the physical and biological environment as well. There is a description of techniques and new methods of analysis as applied to the

water-resource field by social and physical scientists. (See also W71-08291 thru W71-08293) (Siegenthaler-Rutgers) W71-08290

THE ECONOMIC AND SOCIAL IMPLICA-TIONS OF SNOW AND ICE, Southern Illinois Univ., Carbondale.

J. Rooney. In: Water, Earth, and Man, London, Methuen and Co., p 389-401, 1969.

Descriptors: *Economic evaluation, Water supply, Recreation streamflow, Cost-benefit analysis, Correlation, Decision-making.
Identifiers: *Snow zone management, Snow costs,

Utility function.

Estimates are considered of the contribution of snow to agriculture, recreation, and domestic and industrial water supply. The cost of snow-caused disruption and loss of life are evaluated as well. The oisruption and loss of life are evaluated as well. The economic impact of snow-zone water on California and the Western United States agriculture is found to be significant both because of the value of snow as a water-supply source and its dependability in yield. The economic importance of snow-based recreation activity is discussed along with projections of increases in demand. The author finds the most detrimental economic effect of snowfall to be the disruption of communications and allied services. Data on snow disruption is categorized by urban area and impact on various activities. The author suggests the need for systematized decision-making to reduce snows cost of disruption. (See also W71-08290) (Siegenthaler-Rutgers) W71-08291

HUMAN RESPONSE TO FLOODS,

Victoria Univ. (British Columbia).

V. R. Derrick Sewell.

In: Water, Earth, and Man, London, Methuen and Co, Ltd, p 431-451, 1969.

Descriptors: *Flood control, *Flood plain in-surance, Risk, Flood plain zoning, Economic effi-ciency, Floodproofing, Cost-benefit analysis. Identifiers: *Subsidy, Natural tax.

The changing patterns of responses to floods are examined. The author groups the possible adjustments to floods into the following categories: loss acceptance, public relief, emergency action, structural change, flood proofing, land use regulation, flood insurance, and flood control. However, only a few of these possibilities are considered in floodmanagement decision-making with the result that adjustment is much less efficient than if the full range is consulted. The Lower Fraser Valley in British Columbia is used as a case study of responses to a major flood problem. The author finds first that the adjustment to floods in this region is corrective but no preventive and secondly, there has been an increase in the share of costs of flood protection borne by the national government. The author concludes the Fraser River experience suggests that concentration on a narrow range of alternatives may lead to inefficient adjustment, and furthermore, flood losses covered by public subsidy induce firms or activities to locate in areas of substantial flood hazards. To alleviate these problems, a system of flood plain zoning, flood proofing and flood insurance is advised. (See also W71-08290) (Siegenthaler-Rutgers) W71-08292

CHOICE IN WATER USE,

Simon Fraser Univ., Burnaby (British Columbia); and London Univ. (England). T. O'Riordan, and Rosemary J. More.

In: Water, Earth, and Man, London, Methuen and Co., Ltd, p 547-573, 1969.

Descriptors: *Resource allocation, *Pollution abatement, Water supply, Recreation, Water resource management, Flood, Protection, Costbenefit analysis, Systems analysis, Risk.

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

Identifiers: *Externalities, *Opportunity cost, Objective function, Time horizon, Capital cost.

Various techniques used in water resource management are considered for allocating water for multipurpose use and for integrated river-basin development. The purpose of allocation techniques is to discover for any given project the maximum net benefits and to weigh the relative merits of alterna-tive projects. The evaluation process for a multipurpose water-resources system is complicated by problems of collective benefits, externalities, intangibles, uncertainty and opportunity cost. The two approaches to water resource allocation two approaches to water resource allocation discussed are cost-benefit analysis and systems analysis. The advantages and disadvantages of each method are evaluated. These allocation techniques provide a range of possible choices with the actual decision resting in the political institutional process. Decision-makers are faced with physical, fixed, and logal constraints. Examples are sized. fiscal, and legal constraints. Examples are given to illustrate various institutional approaches to water-resource-allocation decision-making. (See also W71-08290) (Siegenthaler-Rutgers) W71-08293

CAPITAL BUDGETING: A MODIFIED APPROACH TO CAPITAL ALLOCATION,

Oregon University, Eugene, Oregon; and Sacramento State College, Sacramento, California.
Leslie P. Anderson, and Vergil V. Miller.
Management Accounting Vol 50, p 28-32, March

Descriptors: *Decision-making, *Economic evaluation, Risk, Resource allocation, Interest rate,

Discount rate.

Identifiers: *Capital budgeting, *Cumulative present value, Opportunity cost, Payback, Present value, Cash flow.

A modification is considered for the present value approach to investment decision making that ena-bles the decision maker to visualize the impact of each variable on the decision making process. The suggested approach is cumulative present value which provides all the benefits associated with the use of the payback criterion as well as those of the more theoretically correct methods of project evaluation such as present value. Cumulative present value shows payback in discounted dollars and compares the discounted income streams of alternative proposals with equal present values. Examples are given that apply the cumulative present value method to investment proposals of varying life expectancies and time periods. This article is relevant for water research concerned with the evaluation of project proposals. (Siegenthaler-Rutgers) W71-08295

REGIONAL INFORMATION DESIGN FOR PUBLIC DECISIONS,

California Univ., Los Angeles.

Werner Z. Hirsch.

Review of Income and Wealth, Series 15, No 4, p 369-380, Dec 1969.

Descriptors: *Decision-making, Regional analysis, Input-output analysis, Cost-benefit analysis, Resource allocation.

Identifiers: *Horizon scanning, Opportunity cost,

The use of regional information, systems are considered as a tool toward improving the quality of policy decisions at the regional level. There are three components of regional information systems: policy-oriented information design, data banks. and analytic models. The information system presented in this paper is based on decision rules that relate to a horizon scanning decision process for uncovering future problems and opportunities. An example is given of the regional information system that classifies the environmental and program information and depicts alternatives futures and potential areas of concern for regional decision-making. This article is relevant to water research concerned with predicting regional water problems and contribution to the evaluation and solution of these problems. (Siegenthaler-Rutgers)

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC EVALUATION OF WATER SUPPLY PRICING IN ILLINOIS, Illinois Univ., Urbana. Hamdy H. H. Afifi. Journal American Water Works Association, Vol 61, No 1, p 41-48, Jan 1969. 5 fig, 2 tab.

Descriptors: *Evaluation, *Marginal costs, Water rates, *Costs, Water demand, Elasticity, Analysis. Identifiers: *Water supply pricing, Community growth, Block rate, Flat rate.

This study analyzed rate-making policies in Illinois and suggested a two-part seasonal rate structure to reflect the economic factors involved. The block rate was commonly used in Illinois, and it was reported in 84.5 per cent of the water rate schedules. The factors affecting water supply prices in Illinois were exposed to a regression model to determine the degree and significance of their relationship to actual charges. The cross-section data on the economic characteristics of the water utilities, the water rate charges, and the economic activities were incorporated into the analysis. The water supply's expected future demand in 1975 was analyzed in terms of different customer class demands, as well as overall water utility demand. The analysis revealed that population served is the primary basis for the expected growth. The economic evaluation of current water rates is concluded with a proposed water rate schedule that can give maximum effect to marginal cost pricing principles as well as the industry's financial requirements. Other study recommendations were discussed. (See also W70-02391) (Wang-Rutgers) W71-07736

COST AND MANPOWER FOR MUNICIPAL WASTE WATER TREATMENT PLANT OPERATION AND MAINTENANCE,

Federal Water Quality Administration, Washington, D.C. Construction Grants and Engineering

For primary bibliographic entry see Field 05D. W71-07743

HANDLING REVENUE AND COST ELEMENTS IN RATE SETTING,

Coffin and Richardson, Inc., Boston, Mass J. C. Adams, Jr., and V. F. Pennacchio.

Journal, American Water Works Association, Vol 62, p 754-764, Dec 1970, 6 tab.

Descriptors: *Rates, *Revenues, *Costs, Program, Operation and maintenance.
Identifiers: *Comparative statement, *Pro Forma Revenues, Quasi-municipal.

The authors graphically present the mechanism of rate-making, with emphasis on the importance of the plant superintendent to the other professionals - the engineers, financial men, and accountants who specialize in the utility field, especially water in setting rates that will yield required income. For a regulated public water utility, typical rate case exhibits are: (1) general map of the system, (2) proposed capital improvement program, (3) proposed financing program, (4) present rate schedules and charges, (5) proposed rate schedules and charges, (6) comparative balance sheet for last three years, (7) comparative statements of original cost of water operating property by primary ac-counts for last three years, (8) comparative income statement for last three years, (9) comparative statements of operating revenues by customer classification for last three years, (10) comparative statements of operation and maintenance expenses

for last three years, (11) actual and pro-forma operation and maintenance expenses, (12) actual and pro-forma income statements, (13) allocation of pro-forma operating revenue requirement to general service and to fire protection services, (14) summary of pro-forms revenues at proposed rates. Examples were shown for exhibit (11) and (12). (Wang-Rutgers)

SURFACE SUPPLY COSTS MORE, FARM BU-

Farmers Home Administration, Champaign, Ill.

D. H. Stoltenberg. Water and Wastes Engineering, Vol 8, No 2, p 23-32, Feb 1971. 3 tab.

Descriptors: *Costs, *Operation and maintenance, Rural areas, Economics, Water supply. Identifiers: FHA, Surface supply.

The average operation and maintenance costs of water systems for communities smaller than 1000 population are discussed. The Farmers Home Administration (FHA) of Illinois has obtained some results by collecting and analyzing statewide data for both FHA and non-FHA financed water system, including well supply, surface supply, and systems that purchase treated water from another community. Tabulated data included average constraint. nity. Tabulated data included average operation and maintenance costs for both FHA and non-FHA financed water system, and breakdown of operation and maintenance costs for FHA financed water system. It concluded that purchased water water system. It concluded that purchased water and well supply rank next to surface supply in average monthly operation and maintenance costs in rural areas, and the average operation and maintenance cost was less per user for the non-FHA systems than for the FHA systems. (Wang-Rutgers) W71-07751

THE CARACAS WATER UTILITY: OVERALL APPRAISAL,

APPRAISAL, National Inst. of Sanitary Works (Venezuela); and Ministry of Public Works, Caracas (Venezuela). P. P. Azpurua, C. Martinez, and P. M. Ruiz. Journal American Water Works Association, Vol 63, p 72-78, Feb 1971. 7 tab, 3 fig.

Descriptors: *Costs, *Returns, Consumption, Rates, Investments, Water demand, Analysis, Or-

ganizations. Identifiers: *Water utility, *Overall appraisal, Social benefits, Sanitary policy, Fair price, Tuy 2,

The findings of a 3-year study of the Caracas Water Utility in Venezuela are summarized. Included are findings regarding financial costs and returns, sofindings regarding financial costs and returns, so-cial benefits, and a look at the future. Tabulated data included water consumption by housing groups, population projection for Caracas, water consumption in Caracas, assumed water demand for Caracas-1981, water control in management rating and water increases as a cost incrementing factor, assumed fair and actual price of the water based on cost alternatives of Tuy 2, and ratio of family income to payment for water service. One conclusion from this analysis is that, if power costs remain at their present level (\$0.0066 kwhr) and wages are not increased more than 5 per cent a wages are not increased more than 3 per cent a year, the utility can operate on an average price of \$0.188/264 gal, during the next three years, which would then be reduced to \$0.166/264 gal, provided the administration is improved substantially. (Wang-Rutgers) W71-07753

CATCHBASINS CLEANED FOR \$3.00. For primary bibliographic entry see Field 05G.

\$37 BILLION: NEW PRICE TAG FOR CITIES' WATER POLLUTION CONTROL COSTS. For primary bibliographic entry see Field 05G.

COST OF DOMESTIC WELLS AND WATER TREATMENT IN ILLINOIS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 04B. W71-08129

COST OF MUNICIPAL SEWAGE TREATMENT PLANTS IN ILLINOIS,

Hilinois State Water Survey, Urbana.
For primary bibliographic entry see Field 05D.
W71-08130

FLOOD CONTROL RELEASE OPTIMIZATION USING METHODS FROM CALCULUS, Colorado Univ., Denver.
For primary bibliographic entry see Field 04A. W71-08192

APPLICATION OF USER CHARGES TO WATER QUALITY MANAGEMENT, Chicago Univ., Ill. Graduate School of Business. For primary bibliographic entry see Field 05G. W71-08196

GENERAL MULTISTAGE MARGINAL COST DYNAMIC PROGRAMMING MODEL FOR THE OPTIMIZATION OF A CLASS OF INVEST-MENT-PRICING DECISIONS, Cornell Univ., Ithaca, N.Y. Dept. of City and Re-

gional Planning.
Courtney Riordan.

Water Resources Research, Vol 7, No 2, p 245-253, Apr 1971. 10 p, 4 fig, 6 ref.

Descriptors: *Optimization, *Dynamic pre-gramming, *Marginal costs, *Investment, *Pricing, Mathematical models, Benefits, Demand, Technology, Economic efficiency.

A general method was developed for finding an optimal solution to the dynamic investment-pricing problem of a publicly owned or regulated monopolistic enterprise with a technology of monopolistic enterprise with a technology of production exhibiting economics of scale given a market demand for the output of the enterprise that is sensitive to price. Four major components of the decision problem were also provided: policy, demand, technology and costs of production, and initial conditions. Each of the first three committees the conditions of the conditions. ponents was subject to the important dimension of uncertainty. Specific assumptions that determined the model were recorded and fell neatly into the four established categories. For the formal con-struction of the model, the total instantaneous net benefit of the operating system was equal to the dif-ference between the area under the demand curve and the area under the short-run marginal cost curve and were expressed algebraically. A discrete dynamic programming algorithm was used to maximize economic efficiency for the investment-pricing problem. The major significance of the model was that it combines the theory of welfare economics and dynamic programming technique to solve the joint investment-pricing problem under a set of structural and procedural assumptions. (Kriss-Cornell)
W71-08204

EFFLUENT CHARGES: WATER POLLUTION CONTROL,

For primary bibliographic entry see Field 06E. W71-08231

STORAGE BASINS FOR WATER SUPPLY, Mid-Cheshire Water Board (England).

Delwyn Davies.

Proceedings of the Third International Congress Pro Aqua, Basel, Switzerland, 1965. Munich, R. Oldenbourg, 1967, p 209-223.

Descriptors: *Water supply, *Storage basin, Water resource planning, Reservoir storage, Flood control, Control, Cost-benefit analysis, Forecasting. Identifiers: *Iso-economic point, Pumped storage

This paper considers some complex and interdependent factors that affect long range planning of a safe and adequate water supply. The author considers four types of storage basins to satisfy future water supply: reservoir basin, pumped storage basin, artificial basin, and a river control scheme. The economic and geographic merits of each scheme are considered in a cost-benefit framework. The storage basin should be planned and completed so that the iso-economic point (where water consumption and drought exceed water supply) is not reached. However, forecasts of water consumption should not neglect water costs arising from scarcity and pollution. The author finds that only through integrated planning of new storage basins for water supply, flood control and other societal needs, can the maximum benefits be achieved. (See also W71-08260) (Siegenthaler-Rutgers) W71-08261

EXTRACTIVE RESOURCES AND TAXATION.

Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06B. W71-08273

CAPITAL BUDGETING, A QUANTITATIVE EVALUATION OF INVESTMENT ALTERNA-

Stanford Univ., Calif. For primary bibliographic entry see Field 06B. W71-08289

UNIQUENESS OF THE INTERNAL RATE OF RETURN WITH VARIABLE LIFE OF INVEST-

MENT, Stanford Univ., Calif. Kenneth J. Arrow, and David Levhari. The Economic Journal, Vol LXXXIX, No 315, p 560-566, Scp 1969.

Descriptors: *Economic evaluation, Capital investment, Interest rate, Discount rate, Project planning.

Identifiers: *Internal rate of return, Present value, Truncation period.

The use and limitations are considered for the internal rate of return as a selection criterion among investment projects. Previous work has indicated that an investment can have multiple internal rates of return if some of the net yields are negative. Maximization of present value with given rates of discount is then recommended as an alternative guide to project selection. The authors show that if there is a constant discount rate and a choice of the truncation period for the project that maximizes present value, then the internal rate of return for the truncated project will be unique. In addition, the authors find that if the life of the project is optimally chosen, then the maximized present value of the project is a monotonic decreasing function of the rate of interest. This article is relevant to water research concerned with decision-making and project selection. (Siegenthaler-Rutgers) W71-08294

CAPITAL BUDGETING: A MODIFIED APPROACH TO CAPITAL ALLOCATION,

Oregon University, Eugene, Oregon; and Sacramento State College, Sacramento, California.
For primary bibliographic entry see Field 06B.
W71-08295

6D. Water Demand

ALLOCATING WATER AMONG ALTERNA-TIVE USES,

Florida Univ., Gainesville. For primary bibliographic entry see Field 06B. W71-07737

HIGH PLAINS IRRIGATION AND TEXAS WATER PLAN, Texas Technological Coll., Lubbock. D. M. Wells.

Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 97, No 1R1, p 123-130, Mar 1971. 4 tab, 7 ref.

Descriptors: *Irrigation, *Benefits, Value, Costs, Projections, Economics, Pumping.

Identifiers: *High Plains, *Secondary benefits, *Tertiary benefits, Farm income, Agriculture, Far-

The economy of the High Plains of West Texas is strongly dependent upon irrigated agriculture. Without the Texas Water Plan, or some similar plan for the importation of water to the High Plains, irrigated agriculture in the High Plains will shortly start a decline that will end in oblivion in less than a century. Of far greater significance will be the decline of secondary and tertiary benefits to other sectors of the economy. Secondary and tertiary benefits associated with irrigation had been estimated to range from about four times the primary benefits in a dry year to about seven times the primary benefits in a reasonably wet year. Current status of irrigation in High Plains, value of irrigation to the High Plains economy, and present cost of irrigation water in High Plains were discussed. It concluded that water should be imported to the High Plains to sustain and enhance the present level of irrigated agriculture in the area. (Wang-Rutgers) W71-07740

ALTERNATIVE USES OF ARID REGIONS,

Ministere du Developpment Industriel et Scientifique, Paris (France). Direction du Gaz et de

Georges Drouhin. Presented at an international conference, 'Arid Lands In a Changing World, Tucson, Arizona, June 1969. In: Arid Lands In Transition, Dregne, H E (ed), Pub No 90, AAAS, p 105-120, 1970. 7 fig.

Descriptors: *Agriculture, Water resources development, *Arid lands, *Tourism, *Mining, Sedimentary basins (Geological), Groundwater, Semiarid climates, Social aspects, Soil types. Identifiers: *Sahara Desert, *Oases, *Fossil soils.

Semiarid and arid lands are generally faced with 3 critical problems: water scarcity, prohibitively expensive power costs, and saline water and soils. Semiarid areas are generally not inhospitable since they usually have some reliable water sources and support extensive agriculture. They are generally amenable to economic development and some sedentary settlement. Arid lands (deserts) are extremely variable, geologically and geographically. Most discussions are confined to the Sahara Desert. The author feels agriculture, mining, and tourism are important areas of potential desert development. The extensive sedimentary basins indicate large aquifers and many artesian zones. Groundwater depletion will probably not be a major problem in the near future. Oasis agriculture should probably concentrate on date palms. The presence of fossil soils indicates a wider distribution of cultivatable soils than formerly thought. In most, but not all areas, water resources are probably adequate to support mining operations. (Casey-Arizona) W71-08135

SOME EFFICIENT DYNAMIC PROGRAMMING ALGORITHMS FOR THE OPTIMAL SEQUENC-ING AND SCHEDULING OF WATER SUPPLY PROJECTS.

Case Western Reserve Univ., Cleveland, Ohio. For primary bibliographic entry see Field 06A. W71-08193

Field 06-WATER RESOURCES PLANNING

Group 6D-Water Demand

REGIONAL AND INTERREGIONAL PLANS FOR WATER DISTRIBUTION (IN FRENCH). Bureau of Water Protection, Neuchatel (Switzer-

For primary bibliographic entry see Field 06B. W71-08262

AN INTERREGIONAL DEMAND-SUPPLY MODEL FOR WATER RESOURCE DEVELOP-

MENT, New Mexico Univ., Albuquerque.

Nathaniel Wallman.

Morgan D. Thomas (ed), The Regional Science Association Papers, Vol 19, p 111-122, 1967.

Descriptors: *Water demand, *Water supply, Water resource development, *Model studies, *Irrigation, *Marginal cost, Agriculture, Surface runoff, Rivers, Population, Watersheds, Fish, Recreation, Effluents, Waste treatment. Identifiers: *Chile, *Marginal cost constraint,

Hydrologic definition.

A demand-supply model based an a study of Chilean water resources is presented. However, the method can be applied in other countries as well. The characteristics of the various water resources are presented, and their distribution and uses are discussed. The construction of the interregional water resource model is delineated, with special attention being given to water regions, water requirements and water supplies, as well as water quality. Factors of flow, requirements, and supply functions of the water resources are presented by provinces, and defined both hydrologically and economically. The results of the model include comparisons between physical requirements and physical sup-plies, assumptions of optimal water resource development limitations, effects of marginal cost constraints, and various alternative allocation adaptations to water shortages. Projections for fu-ture procedures also resulted, focusing particularly on the problems of relating water regulation to the Chilean agricultural sector. (Murphy-Rutgers) W71-08280

6E. Water Law and Institutions

UNITED STATES OCEANS POLICY: AN ANAL-YSIS.

Leigh S. Ratiner.

Journal of Maritime Law and Commerce, Vol 2, No 2, p 225-266 (1971). 42 p, 71 ref.

Descriptors: *International waters, *International law, *Oceans, *United States, Continental margin, law, *Oceans, *United States, Continental margin, Treaties, United Nations, Foreign countries, Continental Shelf, Beds, Coasts, Fishing, Commercial fishing, Navigation, Mineralogy, Oil, Fisheries, Technology, Exploration, Exploitation, Natural resources, Law of the sea, Water pollution, Beaches, Military aspects. Identifiers: *Territorial sea.

Analyzing the oceans policy of the United States, as enunciated by President Nixon and proposed in a draft convention on the international seabed area, this article examines the problem from four perspectives: (1) historical, (2) United States national interests, (3) foreign national interests, and (4) international interests. The article first traces the proliferation of unilateral declarations by nations regarding their jurisdiction over adjacent sea areas. The resulting chaos has brought about efforts to reach an international agreement on the territorial sea and other rights in sea areas. Secondly, the article lists the various United States interests in oceans which include fishing, natural resources exploitation, pollution, military considerations, and navigation. The third section deals with the varying interests of foreign nations, categorizing nations into groups which reflect their geographic and economic situations regarding seabed jurisdiction. The final section considers the international community's interest in oceans and examines specifically the new United States policy and proposed international convention on the seabed area. The United States proposal covers: (1) the territorial sea, (2) the continental shelf boundary, (3) rights in living resources of the sea, (4) rights in mineral resources of the seabed, and (5) navigation through international straits. It creates international straits. tional machinery to govern the seabed area, balances various interests, and serves as a basis for further negotiation. (Duss-Florida)
W71-07707

STATEMENTS ON PROPOSED FEDERAL ACTIONS AFFECTING THE ENVIRONMENT. Council of Environmental Quality, Washington,

Federal Register, Vol 35, No 92, p 7390-7393 (May 1970). 4 p.

Descriptors: *Administrative agencies, *Legislation, *Environment, *Ecology, Administration, Budgeting, Coordination, Legal aspects, Decision making, Federal government, Regulation, Regulation, Government, Regulation, Government, Regulation, Government, Regulation, Government, Regulation, Government, Regulation, Government, Regulation, Regu ments, State governments, Environmental effects, Federal budgets, Local governments. Identifiers: *National Environmental Policy Act of

Pursuant to section 102 (2) (c) of the National Environmental Policy Act of 1971 and Executive Order 11514, the Council of Environmental Quality herein proposes the procedures to be followed by all federal agencies in complying with the Act.
Types of agency actions which may require the
preparation of environmental statements providing
timely public information on federal plans and programs with environmental impact are discussed and defined. A procedure for legislative proposals and recommendations is also outlined. This memorandum specifies the required content of environmental statements. Federal agencies with expertise or jurisdiction in applicable areas are to be consulted in connection with the preparation of environmental statements. There are also provisions for state and local review of proposed action. These environmental statements are to be used in agency review processes and made public. Federal agencles will review their existing authority to determine whether there is anything which prohibits their full compliance with the National Environmental Policy Act and shall make proposals to bring their authority and policies into compliance with the Act. (Robinson-Florida) W71-07708

WATER POLLUTION,

Peter J. Ryan. Albany Law Review, Vol 35, No 2, p 198-218 (1971), 21 p, 145 ref.

Descriptors: *Water pollution control, *Water pollution, *Pollution abatement, *Regulation, Waste water (Pollution), Water law, Federal government, State governments, Local governments, Legal aspects, Legislation, Interstate commissions, Theraspects, Legislation, Interstate commissions, Titel-mal pollution, Wastes, Water quality, Water quality control, Water Quality Act, Water treatment, Sewage disposal, Waste treatment, Sewage treatment, Rivers and Harbors Act, Judicial decisions.

Discussed in this article are the various types of water pollution including mercury, phosphate de-tergents, and thermal pollution and regulation thereof. The water pollution problems of New York City are examined, particularly the Jamaica Bay ecological study and the city's water supply. The article traces the development of common law for the control of water pollution with emphasis on several important cases. Water pollution regulation by the following governmental bodies is also examined: (1) New York City; (2) Interstate Sanitation Commission of Connecticut, New Jersey, and New York; and (3) federal agencies. The Rivers and Harbors Act of 1899, Federal Water Pollution Control Act, and the Water Coultin Act and 1066 Control Act, and the Water Quality Act of 1965 are evaluated as examples of federal control. The problems of enforcing anti-pollution laws are ex-

amined, and the Michigan statute granting to any private citizen the right to sue pollutors on behalf of the general public is discussed. The author feels or the general public is discussed. The author feels that a well-informed and concerned populace is the most potent weapon in the fight to save our environment. (Robinson-Florida) W71-07709

CLASSIFICATION **STANDARDS** WATER SYSTEM FOR THE STATE OF CAROLINA. SOUTH

South Carolina Pollution Control Authority,

Water Classification Standards System, South Carolina Pollution Control Authority (1967). 11 p.

Descriptors: *South Carolina, *Standards, *Water quality control, *Classification, Water pollution quality control, *Classification, Water pollution control, Water pollution sources, Water permits, Water policy, Water quality, Legal aspects, Administrative decisions, State governments, Tidal waters, Fresh water, Decision making, Supervisory control (Power), Regulations, Administration, Non-structural alternatives, Water utilization, Water users, Commercial fishing, Waste disposal. Identifiers: *Auministrative regulations.

Pursuant to statutory authority, nine water classifi-cations and accompanying quality standards, rules, and definitions are herein promulgated by the South Carolina Pollution Control Authority. Such classes and standards are intended to protect public health and to maintain water quality for aquatic life. No treatable wastes shall be discharged without treatment. Compliance tests shall be made under approved procedures of the Pollution Control Authority. Where specific standards are inapplicable, state waters shall be free from: (1) sewage, industrial, or other wastes; (2) floating debris, oil, grease, scum, etc.; (3) substances producing changes in water taste, odor, or color; and (5) high-temperature, toxic, or other deleteri-ous substances. Fresh water classifications are: (1) class AA--suitable for domestic or food processing with only disinfection treatment; (2) class A-swimming waters; (3) class B-domestic use after complete treatment; (4) class C-suitable for fish propagation, industrial, and agricultural use; and propagation, industrial, and agricultural use; and (5) class Cal--fish survival, industrial, and agricultural use. Tidal salt water classes are: (1) class SA-market shellfishing or any other use; (2) class SB-bathing or any other use except market shellfishing; (3) class SC--any usage except bathing and market shellfishing. Fresh and salt-water classifications include quality standards providing specific tolerance limits. (Earl-Florida)
W71-07710

ASSOCIATION ASSOCIATION LOAN AND GRANT ASSISTANCE FOR SOIL AND WATER FACILITIES, INCLUDING WASTE DISPOSAL, RECREATION, GRAZING, AND OTHER FACILITIES.

Secretary of Agriculture, Washington, D.C.

Code of Federal Regulations, Title 7, Chap XVIII, Secs 1823.1 thru 1823.50 (1970). 24 p.

Descriptors: *Loans, *Grants, *Government finance, *Rural areas, Costs, Economics, Federal government, State governments, Local ments, Administration, Legal aspects, Water policy, Water resources development, Drainage, Soil conservation, Grazing, Forestry, Agriculture, Recreation, Waste disposal, Water requirements, Water supply, Capital supply, Credit, Financing.

Outlined herein are the policies and authorities for providing financial assistance to rural communities and other rural associations for water, waste disposal, drainage, recreation, grazing, forestry, and other necessary soil and water facilities. Loans may be made to install or improve community water facilities, including works for the development, storage, treatment, purification, and distribution of water. Loans may also be obtained for com-

munity waste disposal facilities and water facilities for fire protection. Rural community outdoor recreational facilities, including domestic water, irrigation, drainage, and waste disposal facilities developed in connection with recreational areas, are eligible for loans. Loans may be obtained for water control facilities such as dikes, terraces, detention reservoirs, stream channels, and ditches to enhance soil conservation. Development grants may be made to assist in financing specific projects for development, storage, treatment, purification, and distribution of domestic water. The various procedures that must be followed to obtain a loan or grant are explained, as are the responsibilities of the concerned governmental agencies. Governmental officers with loan and grant approval authority are specified. (Robinson-Florida) W71-07711

UNITED STATES V 327 ACRES OF LAND (ENHANCEMENT OF CONDEMNED PROPERTY VALUE DUE TO PROXIMITY TO EARLIER PROJECT).

320 F Supp 844-848 (ND Ga 1971).

Descriptors: *Condemnation value, *Appreciation, *Land appraisal, *Dams, Condemnation, Eminent domain, Compensation, Engineering structures, Damsites, Flow control, Hydroelectric power, Impoundments, Reservoirs, River regulation, United States, Georgia, River basins, Water control, Water storage, Hydroelectric plants, Federal government, Regulation, Economic impact, Judicial decisions, Legal aspects, Multiple-purpose projects.

Plaintiff United States brought action to condemn property for construction of a regulation dam and impoundment area. Plaintiff contended that the dam was part of a larger hydroelectric power project and that, as such, defendant landowner should receive for compensation the value of the lands condemned without an allowance for enhanced value due to proximity to the project. Defendant landowner contended that the regulation dam was not within the original scope of the project, and that the value of the land should include its value as enhanced by the factor of proximity. On the preliminary motion, the United States district court ruled that evidence as to enhanced value of the land was admissible. The court noted that long history of the power project, during which the regula-tion dam concept had been rejected. After a distinct tract has been condemned, the government, at a later date, must pay the market value of any additional land as enhanced by proximity to the original project, unless such additional land was contemplated as a part of the original plan. (Smiljanich-Florida) W71-07712

UNITED STATES V 901.89 ACRES OF LAND (VALUE OF RETAINED LAND ENHANCED BY CONDEMNATION FOR PUBLIC PROJECT). 436 F2d 395-401 (6th Cir 1970).

Descriptors: *United States, *Condemnation value, *Land appraisal, *Appreciation, Impounded waters, Condemnation, Eminent domain, Compensation, Economic impact, Dams, Damsites, Lakes, Lake shores, Aesthetics, Appraisals, Recreation, Flood control, Boundaries (Property), Judicial decisions, Federal government, Legal aspects.

Plaintiff United States brought condemnation proceedings against defendant landowner. Plaintiff contended that an award for compensation of the land condemned for construction of a dam should take into consideration the enhancement of value of retained land due to its proximity to the created lake. Defendant contended that enhancement of retained land value was a general benefit which was not to be considered in awarding compensation. In reversing a lower court award for defendant, the United States Court of Appeals, Sixth Circuit, or dered that the increase in value of retained land due to proximity to the lake should be considered in awarding compensation. The court distinguished

general benefits, which arise from the fulfillment of the public object that justified the taking, and spe-cial benefits that arise from the peculiar relation of the land in question to the public improvement. General benefits are not included in valuation of retained land, but special benefits are properly included. The proximity of retained land to a created lake falls within the category of a special benefit. (Smiljanich-Florida)

SALINE WATER CONVERSION PROGRAM--

APPROPRIATION.

Public Law 91-221, 84 Stat 87, 4 US Code Cong and Admin News p 534-535 (1970). 2 p.

Descriptors: *Saline water, *Desalination, *Government finance, *Desalination apparatus, Desalination plants, Federal government, Water sources, Financing, Costs.
Identifiers: *Saline Water Conversion Act.

The following appropriations for efforts under provisions of the Saline Water Conversion Act are authorized by this law: (1) \$16,150,000 for research and development operating expenses, provided that no more than \$100,000 may be obligated for procurement of research services from foreign nations; (2) \$5,000,000 for design, construction, acquisition, modification, operation, and maintenance of saline water conversion test beds; (3) \$5,345,000 for design, construction, acquisition, modification, operation, and maintenance of saline water conversion modules; and (4) \$2,378,000 for administration and coordination. Expenditures for any of these four areas may be increased by 10% with a commensurate decrease in expenditures under other areas. (Hart-Florida) W71-07714

ENVIRONMENT, Richard M. Nixon.

116 Cong Rec H 743 (daily ed) 2 US Code Cong and Admin News, p 112-123 (1970). 12 p.

Descriptors: *Environment, *Water pollution control, *Air pollution, *Water pollution, Parks, Recreation, Water pollution sources, Cities, Industry, Farm wastes, Agricultural chemicals, Real property, Administrative agencies, Administrative decisions, Administration, Pollutants, Pollution abatement, Ecology, Federal project policy, Environmental effects, Solid wastes, Waste disposal.

President Nixon's 1970 environmental message to Congress discusses pollution abatement measures in several areas of environmental deterioration. Water pollution is stated to have three principal sources: (1) municipal, (2) industrial, and (3) agricultural. Surprisingly, pollution from agricultural sources is considered the most troublesome. The phaseout of DDT is cited as an action taken to abate agricultural pollution. President Nixon proposes various means of abating municipal pollution, including creation of an Environmental Financing Authority to assist municipalities in selling waste treatment construction bonds. The present industrial pollution abatement program is criticized for lack of an effluent standard. Seven proposals are submitted to correct industrial pollution. In two subparts, motor vehicular and stationary source pollution, the President proposes corrective measures with respect to air pollution. In a discussion of solid waste management President Nixon proposes programs for re-use or processing of disposable containers and junk autos. More efficient use of federal land for parks and public recreation is recommended. A final section suggests methods for implementing environmental improvement proposals. (Hart-Florida) W71-07715

CLEAN AIR AND CLEAN WATER SCHOLAR-SHIP INTERN PROGRAMS--QUALIFIED SHIP INTERN DEGREES.

New Jersey Session Law Service, ch 274 (1970). 3

Descriptors: *New Jersey, *Scientific personnel, *Education, *Engineering education, Employment opportunities, Professional personnel, Air pollution, Water pollution, Environmental engineering, Universities, Colleges, Grants, Training, Financing, Employment, Occupations, Contracts, Wages, Administrative agencies, State governments, Legislation, Social aspects, Legal aspects, Schools (Educa-

Identifiers: *Environmental scholarships.

Clean air and clean water scholarship intern programs are established whereby the New Jersey Department of Environmental Protection may provide payment of room, board, tuition, and fees for eligible persons on a competitive basis. The persons must attend authorized universities as regular students and receive an engineering degree or a degree with a major in the biological, physical, or environmental sciences. Among other qualifica-tions, the student must contract, with the consent of his parent or legal guardian if he is a minor, to serve with the Department of Environmental Protection for a period of three years following graduation. The student must also agree to serve with the Department during his summer vacations. The Department shall not be liable to pay wages to the stu-dent during these vacation periods. (Smiljanich-Florida) W71-07716

MARINE POLLUTION PROBLEMS AND

Oscar Schachter, and Daniel Serwer. American Journal of International Law, Vol 65, No 1, p 84-111 (1971). 28 p, 83 ref.

Descriptors: *International waters, *Water pollution control, *Water pollution sources, *International law, Water pollution, Pollution abatement, Water pollution effects, Aquatic environment, Oil, Oily waters, Chlorinated hydrocarbon pesticides, Coasts, Ships, Waste disposal, Pollutants, Sea water, Treaties, International commissions, Administrative agencies, United Nations, Foreign countries, Governments, Remedies, Legal aspects.

Marine pollution is a global problem of great magnitude. No single measure or type of measure on either the national or international level is adequate to meet the range of marine pollution problems. Marine pollution control measures must be tailored carefully to fit particular problems. A summary is made of what is known about pollution sources, the extent to which they are found in the marine environment, how they affect the marine environment, what international controls now apply, and the prospects for future pollution and its control. Four specific marine pollution problems and their remedies are discussed. These include pollution caused by oil, chlorinated hydrocarbons, wastes discharged from coasts, and wastes dumped from vessels. The international machinery used to deal with these problems has not been effective. Comprehensive international conferences on the problems are needed, along with a greater recognition of the need for regional pollution control organs. A large part of the solution also lies in making old institutions more effective and maintaining the needed pressure from scientists, professional groups, and the public at large. (Smiljanich-Florida) W71-07717

NATIONAL WATER QUALITY STANDARDS ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT).

Senate Bill 523, 92d Cong, 1st Sess Feb 2, 1971. 48

Field 06-WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Descriptors: *Water quality control, *Water pollution, *Water pollution control, *Legislation, Water quality, Federal government, State governments, Local governments, Coordination, Waste treat-ment, Treatment facilities, Water policy, Standards, Regulation, Sewage, Water pollution sources, Costs, Cost sharing, Grants, Government finance, Public rights, Environment, Environmental effects, Bodies of water, Administrative agen-

Identifiers: *National Water Quality Standards Act of 1971, *Federal Water Pollution Control Act.

Amending the Federal Water Pollution Control Act, the proposed National Water Quality Standards Act of 1971 seeks to: (1) establish water quality standards and provide for their revision, (2) provide federal assistance to state and local governments for construction of waste treatment facilities, (3) provide improved assistance to state and interstate water pollution control agencies in the area of water pollution control and water quality enhancement, (4) improve water quality enforcement measures, and (5) assure public participation in federal programs relating to the quality of the nation's waters. The Act would authorize the Administrator of the Environmental Protection Agency to make grants to state and interstate agencies for water quality and pollution control programs and assist in various aspects of their implementation. Subsections cover procedural requirements, discretion of the Administrator, and funding of programs. The Administrator is authorized to make grants for the construction of waste treatment works. Subsections govern the implementation of this provision. The Act calls for formulation and implementation of water quality control and enhancement programs. Factors to be considered and procedures to be followed in approving and coordinating such plans are outlined. Federal enforcement procedures include both civil and criminal penalties for violation of various portions of the Act. (Duss-Florida)

SANTA BARBARA CHANNEL MORATORIUM AND ECOLOGICAL PRESERVE ACT (A BILL TO PROVIDE FOR A FEDERAL ECOLOGICAL PRESERVE IN A PORTION OF THE OUTER CONTINENTAL SHELF).

Scnate Bill 373, 92d Cong, 1st Sess, Jan 27, 1971. 9

Descriptors: *Leases, *Oil, *Channels, *Water pollution sources, Pollution abatement, Oil fields, Water quality control, Federal government, Water quality Collide, Federal government, Legislation, Coasts, Shores, Drilling, Beds under water, Pacific Ocean, Ownership of beds, Gases, Mineralogy, Wildlife management, Oil industry, Oil reservoirs, Oil wells, Oily water, Offshore plat-forms, Exploitation, Legal aspects, Navigation.

In response to recent events concerning the Santa Barbara Channel oil spill, the Santa Barbara Channel Moratorium and Ecological Preserve Act would regulate future oil production and create a federal ecological reserve in the area. Present drilling and production methods constitute an environmental and navigational hazard and a threat to Santa Barbara and its submerged lands sanctuary. The Act would terminate certain leases in the channel with just compensation from appropriations provided herein. The areas in which the leases are terminated would become a federal ecological preserve, which would not be subject to drilling for or production of oil, gas or other minerals. Drilling on certain other leases would be suspended until the Secretary of the Interior insures that future oil spillage can be prevented, ecological hazards can be minimized, and underwater production techniques have been perfected and will be used so that no apparatus is visible above the surface of the water or creates a navigational hazard. Three leases would be allowed to continue operating until oil spillage and leaks in the channel have been minimized. (Smiljanich-Florida) W71-07719

WATER RIGHTS ACT OF 1971 (A BILL TO CLARIFY THE RELATIONSHIP OF INTERESTS OF THE UNITED STATES AND OF THE STATES IN THE USE OF THE WATERS OF CERTAIN STREAMS).

Senate Bill 28, 92d Cong, 1st Sess, Jan 25, 1971. 5

Descriptors: *Federal-state water rights conflicts, *Reservation doctrine, *Compensation, *Legislation, Water resources development, Regulation, Federal governments, State governments, Governments, Federal jurisdiction, State jurisdiction, Water rights, Legal aspects, Administration, Condemnation, value, Prior, appropriation, Pinagian demnation value, Prior appropriation, Riparian rights, Competing uses, Prescriptive rights, Water sources, Water utilization, Water resources, Water

Under this proposed legislation the withdrawal or reservation of surveyed or unsurveyed lands of the United States would not affect any right to the use of navigable or non-navigable water acquired pursuant to state law either before or after the establishment of such withdrawal. In the latter case a federal statute or a promulgation by an appropriate officer of the United States of the pursuant to the case of the states of the pursuant case. pose, quantity, and priority date of the water right reserved to the United States would defeat rights under state law. No right to diversion, storage, distribution, or use of water which the United States asserts to have been established under the laws of a state shall be greater or less than those accorded by the laws of that state to other users. No vested water rights shall be taken or used by the United States without just compensation. If works of the United States interfere with any vested compensable water rights, the United States shall initiate eminent domain proceedings. If this is not done, no statute of limitations shall apply against a suit by an injured party for compensation. (Robinson-Florida) W71-07720

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO PROTECT THE NAVIGABLE WATERS OF THE UNITED STATES FROM FURTHER POLLUTION BY REQUIRING THAT PESTICIDES COMPLY WITH CERTAIN STANDARDS OF BIODEGRADABILITY AND TOXICITY

Senate Bill 281, 92d Cong, 1st Sess, Jan 26, 1971. 3

Descriptors: *Water pollution control, *Pesticide toxicity, *Legislation, *Biodegradation, Pesticide residues, Federal government, Water quality control, Navigable waters, Pesticides, Fungicides, Herbicides, Pesticide removal, Public health, Environmental sanitation, Chemical wastes, Pollutants, Water pollution sources, Nonstructural alternatives, Water quality, Hazards, Insecticides, Legal aspects, Regulation, Administration.

Identifiers: Federal Water Pollution Control Act.

This proposed amendment to the Federal Water Pollution Control Act mandates pesticide biodegradability and toxicity standards and prohibits the manufacture or importation of substandard pesticides. Under the bill, the Secretary of the Interior would be required to prescribe standards and rules preventing non-conforming pesti-cide manufacture by January 1, 1973. The Secreta-ries of the Interior and the Treasury would be required to promulgate rules preventing the importation of such pesticides. All standards and rules promulgated under this bill would become effective July 1, 1973. Willful violation of the provisions of this bill or pursuant regulations would constitute a misdemeanor. First offenses are punishable by a fine not exceeding \$500. Subsequent offenses are punishable by a fine not exceeding \$2,000. As used in this bill 'pesticide' means any fungicide, herbicide, rodenticide, or insecticide. (Earl-Florida) W71-07721

A BILL TO PRESERVE AND PROMOTE THE RESOURCES OF THE CONNECTICUT RIVER VALLEY.

Senate Bill 318, 92d Cong, 1st Sess, Jan 27, 1971.

Descriptors: *Interstate rivers, *New England, *National historic sites, *Preservation, Federal government, State governments, Legislation, Eminent domain, Condemnation, Scenic easements, History, Ecology, Recreation, Acreage, Industrial production, Natural resources, Conservation, Inter-agency cooperation, Riparian land, Shore protection, Beach erosion, Legal aspects, Standards, Regulation.

In order to provide for the conservation of the scenic, historic, ecological and recreational values of the Connecticut River Valley, this bill would establish the Connecticut Historic Riverway. The establish the Connecticut Historic Riverway. Ine Secretary of the Interior would be authorized to condemn lands necessary to carry out the purposes of the Act. The Secretary would also be authorized to specify standards regulating new commercial or industrial uses of such property and promoting its protection and development by means of acreage, The primpary aim of the Act would be the conservation of the natural resources located within the Riverway and the preservation of the area in as nearly its natural state and condition as possible. Advisory committees would represent the various states in which the Riverway is located. Inter-agency cooperation would foster plans for shoreline rosion control along the Connecticut River. (Smiljanich-Florida) W71-07722

LAND AND WATER RESOURCES PLANNING ACT OF 1971 (A BILL TO AMEND THE WATER RESOURCES PLANNING ACT TO IN-CLUDE PROVISION FOR A NATIONAL LAND USE POLICY).

Senate Bill 632, 92d Cong, 1st Sess, Feb 5, 1971.

Descriptors: *Water Resources Planning Act, *Land use, *Land development, *Water resources development, Planning, Land resources, Land management, River basin commissions, Legislation, Federal government, State governments, River basin development, Water policy, Land, Grants, Long-term planning, Federal project policy, Coordination, Administration, Environmental effects, Social aspects, Legal aspects.
Identifiers: *Land and Water Resources Planning

Pursuant to findings that a comprehensive ap proach to land use management is needed, this bill would amend the Water Resources Planning Act to include provision for a national land use policy by broadening the authority of the Water Resources Council and river basin commissions and by providing financial assistance for statewide land use planning. The Land and Water Resources Planning Act of 1971 would: (1) establish a Land and Water Resources Council with authority to coordinate land and water policy in the nation; (2) authorize establishment of river basin commissions to include coordination of plans for the development of land and water resources in the river basin area; and (3) provide for a national land use policy. The land use policy would be implemented through statewide and interstate land use planning grants and state water resources planning grants. The na-tional land use policy would entail land use planning and development in accordance with: (1) sound ecological principles, (2) beneficial economic activity, (3) favorable population distribution, and (4) coordination of state and federal activities. (Smiljanich-Florida) W71-07723

MARSHALL V HARTMAN (RIPARIAN RIGHTS ON LAND ABUTTING PUBLIC STREET).

139 So 441-448 (Fla 1932).

Water Law and Institutions—Group 6E

Descriptors: *Florida, *Navigable waters, *Riparian rights, *Riparian land, Easements, High water mark, Beds, Channels, Landfills, Cities, Land tenure, Contracts, Legal aspects, Judicial decisions, Boundaries (Property), Boundary disputes,

Plaintiff sought rescission of a contract to buy land. Plaintiff alleged that defendant vendors faisely represented that the land possessed riparian rights and that the contract itself called for riparian rights. Defendants denied the allegations and contended that they never claimed any riparian rights and that the contract conveyed only such rights as they had. Defendants asked for specific performance. The trial court found for plaintiff and the Supreme Court of Florida reversed. The contract did not purport to assert any riparian rights. The reference to riparian rights in the contract conveyed only those rights which might be found to exist. The vendee was on notice that the land might not have any riparian rights because of the presence of the city street on the edge of the pro-perty and the city's landfill between the street and the river. The general rule is that a grantee of land abutting a street, whose grantor owned title under the street, is presumed to own soil to the center of the street subject to the public easement, and is not vested with riparian rights in water or submerged land abutting the opposite side of the street. (Duss-Florida) W71-07739

BOARD OF PURIFICATION OF WATERS V TOWN OF EAST PROVIDENCE (STATE POWER TO REQUIRE CITY TO ABATE POL-LUTION OF RIVER). 133 A 812-815 (RI 1926).

Descriptors: *Rhode Island, *Administrative agencies, *Water pollution, *Water pollution control, Water purification, Sewage, Sewage treatment, Rivers, Public health, Water pollution sources, Water pollution effects, Prescriptive rights, Costs, Legislation, Sewage effluents, Cities, Legal aspects, Judicial decisions, Pollution abatement, Regulation

Plaintiff Rhode Island Board of Purification of Waters instituted proceedings to require defendant town of East Providence to implement a system to prevent pollution of a river. Defendant was dumping raw sewage into the river. Plaintiff issued an order for defendant to adopt a system to prevent pollution, and defendant appealed to the Supreme Court of Rhode Island. Defendant questioned the constitutionality of the law creating and giving powers to the plaintiff and the reasonableness of the Board's order. The act creating the Board and giving it powers relating to pollution of waters was within the police power of the state to protect public health. The act was not an ex post facto law as it related to anticipated future actions. The right to pollute public waters and endanger public health cannot be acquired as a private property right. No one can acquire a prescriptive right to endanger public health by discharging sewage into public waters. The state cannot be required to pay the offender for discontinuation of the practice. Plaintiff's order was not unreasonable and defendant's inaction and delay in financing the needed system was not justified. (Duss-Florida)
W71-07741

CITY OF NORWOOD V SHEEN (DAMAGES FOR SEWAGE FLOW ON PRIVATE PROPER-186 NE 102-107 (Ohio 1933).

Descriptors: *Ohio, *Eminent domain, *Sewage disposal, *Damages, Sewers, Sewage, Land, Land tenure, Drains, Water pollution, Drainage systems, Overflow, Surface waters, Pipes, Storm drains, Floods, Cities, Waste water (Pollution), Wastes, Waste disposal, Compensation, Legal aspects, JudiPlaintiff executor brought suit for damages against defendant city for appropriation of decent's property. Plaintiff alleged that defendant had taken over a private sewer during decendent's lifetime and operated it so as to flood and pollute decendent's property. Plaintiff charged that this amounted to an appropriation of the property. Defendant contended that: (1) plaintiff's action was grounded in negligence and could not be maintained in the absence of a negligence statute governing the operation of sewers; (2) there was no appropriation: and (3) the issue of damages was Plaintiff executor brought suit for damages against appropriation; and (3) the issue of damages was improperly submitted to the jury. Plaintiff recovered at the trial level. The Supreme Court of Ohio reversed on the issue of damages. Plaintiff's action was not grounded in negligence, but was based on appropriation of private property for a public use. The petition alleging that defendant used the sewer and drain facilities so as to cause flooding and pollution of property stated a good cause of action against defendant for temporary appropriation of private property for a public use. However, since the injury was not permanent, evidence regarding the value of the land was not admissible, and the trial court should have charged the jury as to what measure of damages was applicable. (Duss-Florida)
W71-07742

WILSON V CITY OF LAURENS (DAMAGES DUE TO NEGLIGENT CONSTRUCTION OF DRAINAGE SYSTEM). 132 SE 590-591 (SC 1926).

Descriptors: *South Carolina, *Drainage systems, *Surface drainage, *Surface runoff, Drains, Eminent domain, Damages, Compensation, Benefits, Cities, Construction, Maintenance, Floods, Diversion, Surface waters, Judicial decisions, Legal aspects.

Plaintiff landowner sought damages from defendant city for flood damages to his property due to defendant's negligent construction and main-tenance of a drainage system. Plaintiff alleged that defendant altered the drainage system so that in time of flood, water was diverted onto plaintiff's property. Defendant contended that: (1) the improvements were made properly, (2) they benefited plaintiff's property, and (3) no damage to plaintiff resulted from any defect in the drainage system or anything under defendant's control. In the trial court the jury returned a verdict for plain-tiff. Defendant appealed on the grounds that plain-tiff should have brought his action under a statute requiring compensation for damages arising from street improvements, and that the trial judge failed to properly charge the jury concerning the benefits of the system. The Supreme Court of South Carolina affirmed. Plaintiff's cause of action was grounded in the city's failure to provide a proper system of surface drainage, and required no statu-tory basis. Because of plaintiff's theory of negligence, no charge regarding benefits was necessary. (Duss-Florida) W71-07744

ROSE ISLAND CO V UNITED STATES (DAMAGES TO AMUSEMENT PARK BY OVERFLOW FROM DAM BACKWATER). 46 F2d 802-804 (WD Ky 1930).

Descriptors: *Dams, *Backwater, *Compensation, *Streams, Non-navigable waters, Riparian land, Riparian waters, Damages, Real property, Parks, Boating, Recreation, United States, Legal aspects, Judicial decisions.

Plaintiff riparian landowner sued for compensation when defendant United States' dam caused his land to be overflowed. A small non-navigable stream flowed through plaintiff's land into the Ohio River.
Defendant's dam caused the water to rise in this stream. Plaintiff used the property as an amusement park and asserted that the increased depth of the stream lessened its attractiveness as a boating stream for the park. The Federal District Court

held that defendant must compensate plaintiff for any injury caused by the dam. However, the lessen-ing of the stream's attractiveness for boating was held too conjectural and uncertain to permit recovery. Recovery was allowed for injury to plain-tiff's parking lot and for narrow strips of plaintiff's property along the creek which were permanently submerged. (Hart-Florida) W71-07745

DALCHE V BOARD OF COMM'RS OF ORLE-ANS LEVEE BD (CONSTITUTIONALITY OF TAKING RIPARIAN LAND FOR RESIDENTIAL PROPERTY). 49 F2d 374-385 (ED La 1931).

Descriptors: *Lakes, *Eminent domain, *Flood control, *Marshes, Condemnation, Real property, Riparian land, Riparian waters, Compensation, Payment, Legislation, State governments, Cities, Legal aspects, Judicial decisions, Louisiana. Identifiers: *Constitutionality.

Plaintiff landowner sought to enjoin defendant board of commissioners from condemning his riparian land. Plaintiff contended that the proposed riparian land. Frankin contended that the proposed taking was for a private purpose in violation of the 14th amendment. Defendant planned to erect a sea wall along plaintiff's property and to reclaim a portion of lake bottom and marshlands. The area thus taken was to be converted into a residential section. Thirty per cent of the property was to be dedicated for a public amusement park. The project would eliminate flooding of New Orleans and alleviate mosquito proliferation. The Federal District Court held that a proper public purpose was performed by the project and rejected plaintiff's contention. Plaintiff's suit was dismissed, the court noting that a right of action for compensation existed. (Hart-Florida) W71-07748

UNITED STATES V KINCAID (INJUNCTION TO PREVENT FLOOD CONTROL PROJECT PROCEEDING UNTIL LAND TO BE OVER-FLOWED HAS BEEN ACQUIRED).

49 F2d 768-769 (5th Cir 1931).

Descriptors: *Mississippi River, *Flood control, *Flooding, *Eminent domain, Condemnation, Real property, Riparian land, Riparian waters, Administrative agencies, Compensation, Remedies, Legal aspects, Judicial decisions, Federal government, United States.

Plaintiff riparian landowner sought to enjoin defendant United States from proceeding with a flood control project which would subject plaintiff's land to more severe flooding. The land had not been acquired for flooding either by purchase or condemnation. The Fifth Circuit Court of Appeals granted an injunction until defendant had acquired the property or flowage rights thereon. (Hart-Florida) W71-07749

UNITED STATES V BOYNTON (BOUNDARY OF RIPARIAN LAND WHICH HAD BEEN MEANDERED). 53 F2d 297-298 (9th Cir 1931).

Descriptors: *Accretion (Legal aspects), *Boundary disputes, *Meanders, *Land tenure, Real property, Boundaries (Property), Riparian land, Riparian waters, United States, High water mark, Tides, Legal aspects, Judicial decisions, Surveys.

Plaintiff United States brought action to quiet title to accretions to riparian land on an Indian reserva-tion. The land had been surveyed by the United States for allotment to individual members of the tribe. The surveyor meandered along the water. Plaintiff contended that the boundary of the tract was the high water mark; defendant asserted that the boundary was fixed by the survey. To prove its

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contention, plaintiff endeavored to show that the survey had merely meandered along the water line to designate the high water mark generally. Meander lines were defined as referring to the water line itself, subject to tides and water levels. The United States Court of Appeals determined that meander lines were not normally fixed boundaries; hence, the court concluded that the conveyance must expressly provide that the meander was a fixed boundary to alter that rule. Since the conveyance was silent on the matter, the court held that the high water mark, rather than the meander, was the boundary of the tract. (Hart-Florida) W71-07750

LIPSCOMB V GIALOURAKIS (TERRITORIAL BOUNDARIES OF GULF STATES). 133 So 104-107 (Fla 1931).

Descriptors: *Florida, *Gulf of Mexico, *Boundary disputes, *Jurisdiction, Gulfs, Legal aspects, Judicial decisions, State governments, Governments, Legislation, Bodies of water, Local governments, Fishing, Commerical fishing, State jurisdiction.

Defendants were tried for using illegal methods to catch sponges and for taking sponges below the minimum size in the Gulf of Mexico. The state appealed a judgment by the Circuit Court of Taylor County discharging the accused. Defendants con-tended that the indictment showed on its face that the offense was not committed within the jurisdiction of Taylor County. The Supreme Court of Florida reversed the judgment and held that the indictment sufficiently charged that a statutory of-fense had been committed within the jurisdiction of Taylor County. All the bottoms of the gulfs and natural bays within the limits of the State of Florida passed to the State of Florida when Florida was admitted to the Union. The counties bordering on the Gulf of Mexico include that area within the Gulf adjacent to the upland and extending to the state boundary line. (Robinson-Florida) W71-07754

CITY OF BIRMINGHAM V FLOWERS (DAMAGES RESULTING FROM IMPROPER CULVERT)

140 So 353-356 (Ala 1932).

Descriptors: *Alabama, *Controlled drainage, *Culverts, *Flood damage, Legislation, Judicial decisions, Drainage, Surface drainage, Drains, Engineering structures, Structures, Channels, Conduits, Local governments, Governments, Damages, Flood control, Floods, Water injury, Legal aspects.

Plaintiff landowner sued defendant city for damages to property caused by an overflow of water from a culvert. Defendant alleged as error the refusal of the following charges to the jury: (1) the jury could not award any damages to plaintiff for negligent construction of the culvert, since the complaint asserted only negligence in maintenance, and (2) the failure of plaintiff to report the overflow within a reasonable time defeated his right to recover. Defendant also challenged an instruction stating that, if a reasonable man should have known that the culvert was insufficient, defendant should be held liable for damages. The trial court rendered judgment for plaintiff, and the Supreme Court of Alabama affirmed. The complaint charging defendant with maintaining a permanent, inadequate culvert stated a single cause of action for permanent damage. If the drainage system itself was proper, and the damage resulted from inadequate maintenance, each recurring injury created a separate cause of action. The measure of damages for permanent injury was properly the difference in value of the land before and after the overflows, present and prospective. The complaint was not defective in failing to assert negligence in construction, since negligent construction also constitutes negligent maintenance. (Robinson-Florida) W71-07824

SEWER AND ENVIRONMENTAL ASPECTS OF WATER QUALITY STANDARDS, For primary bibliographic entry see Field 05G. W71-07848

THE DESIGNATION OF THE AREA AND THE WATER QUALITY STANDARD OF THE RIVER

For primary bibliographic entry see Field 05G. W71-07851

CLEVELAND FACES POLLUTION SUIT. For primary bibliographic entry see Field 05G. W71-07853

MARTIN V GRAVITY DRAINAGE DIST NO 14 (ENLARGING GOV'T DRAINAGE DITCHES ON PRIVATE LAND). 143 So 93-95 (La Ct App 1932).

Descriptors: *Louisiana, *Ditches, *Drainage districts, *Controlled drainage, Legislation, Judicial decisions, Legal aspects, Governments, State governments, Local governments, Damages, Drainage systems, Drainage engineering, Drainage programs, Drainage, Drainage water, Drainage practices, Water control, Channeling, Channels, Canals, Land tenure, Real property, Eminent domain, Remedies.

Plaintiff landowner sued defendant drainage district for damages ensuing when defendant widened and deepened an old drainage ditch on plaintiff's property and piled the excavated dirt on plaintiff's land. Plaintiff contended that he had lost 2.18 acres of land. Defendant alleged that the ditch was not made any deeper or wider than was necessary and the the spoil dirt had to be piled on plaintiff's land. Defendant further argued that plaintiff was estopped from bringing the action by his silence at the time of the work and that the benefits exceeded the damages. Defendant also alleged that it had control over 100 feet on each side of the ditch under a Louisiana statute. The trial court dismissed the complaint. The Louisiana Court of Appeal affirmed, stating that plaintiff had not proven the extent of his damages. The court held that the statute giving the drainage district control of 100 feet on both sides of the ditch did not deprive landowners of the right to recover the value of the land taken. The fact that benefits exceed damages is no defense, since a plaintiff is assumed to pay for these benefits by payment of taxes. (Robinson-Florida) W71-07862

CITY OF VICKSBURG V PORTERFIELD (CI-TY'S RESPONSIBILITY TO MAINTAIN DRAINS FREE OF OBSTRUCTION), 145 So 355-357 (Miss 1933).

Descriptors: *Mississippi, *Floods, *Flood damage, *Storm drains, Land tenure, Land use, Legal aspects, Public rights, Judicial decisions, Local governments, Governments, Drainage, Drainage water, Drainage engineering, Controlled drainage, Drains, Culverts, Sewers, Flood control, Overflow, Storm runoff, Water injury, Water con-

Defendant city allowed a drain pipe to become clogged so that during a hard rain the water rose and flooded the property of plaintiff. Plaintiff sought damages. Defendant contended that the rain was excessive and that it was not bound to provide for unusual and excessive rainfall. Defendant further contended that it had acquired a prescriptive right to allow continuance of the condition without liability. Defendant maintained that an instruction of the lower court stating that when the city built the embankment and drain the law imposed a duty upon the city to keep said drain open and free from obstruction was error. The Supreme Court of Mississippi affirmed a decision for the plaintiff. A city maintaining a public street is under a duty to keep the drains under the fill in proper

condition, whether or not the city constructed the condition, whether or not the city constrained and drain. A city must provide for such floods as may reasonable be expected, judging from such as have previously occurred, but is not liable for damages which could not have been provided for or guarded against. In the instant case the rainfall causing injury was not unprecedented and could have been guarded against. (Robinson-Florida) W71-07869

HAAS V ARDOIN (LIENS CREATED BY FURNISHING WATER FOR CROPS). 145 So 388-390 (La Ct App 1933).

Descriptors: *Louisiana, *Water contracts, *Leases, *Crop production, Crops, Cultivated lands, Irrigation, Rice, Irrigated land, Water rights, Legislation, Judicial decisions, Contracts, Farm management, Farms, Legal aspects, State jurisdiction, Lakes, Water supply.

Plaintiff shareholder sued defendant farmer for the face value of a note executed by defendant. Plaintiff obtained a writ of sequestration, and 903 sacks of rice owned by the defendant were seized. A party who had made advances to the defendant for the making of this rice crop intervened. The intervener held a warehouse receipt for the rice as security for his advances. Plaintiff contended that security for his advances. Plaintiff contended that his note was in payment for rental of a lake to furnish water for defendant's rice crop. Plaintiff also claimed the statutory privilege of a person who furnished water to another for the making of a crop. This statutory privilege gave such furnisher of water a privilege co-equal with the privilege of those who advanced supplies for making a crop. The Louisiana Court of Appeal affirmed a decision for the intervener. The court held that the Act creating the statutory privilege relied on the plain. granting the statutory privilege relied on by plaintiff required a specific agreement that the water be used for the making of a crop. The agreement in question was only for rent of a lake and land, with no purpose specified. (Robinson-Florida)

POLLUTION STINK FOULS CITY HALL, For primary bibliographic entry see Field 05G. W71-07872

NAVIGABLE WATERS OF THE UNITED STATES (SUPREME COURT DEFINITIONS OF NAVIGABILITY).

Department of the Army, Washington, D.C.

33 Code of Federal Regulations, Sec 209.260 (1970). 2 p.

Descriptors: *Navigable rivers, *Navigable waters, *Non-navigable waters, *Navigation, Judicial decisions, Administration, Ownership of beds, Riparian rights, Riparian waters, Rivers and Harbors Act. Legislation, Bodies of water, Legal aspects, Federal government, Federal jurisdiction, Regulation, State jurisdiction, Natural use, Obstructions to flow,

For informational purposes, definitions of 'navigable waters', under Supreme Court decisions, are herein provided. Rivers used, or susceptible to use in their ordinary condition as highways for com-merce are navigable-in-fact. They constitute navigable waters of the United States, as opposed to navigable state waters, when by themselves or by uniting with other waters they form a continued highway for interstate or foreign commerce. Their capability of transportational and commercial uses, not the extent and manner of use, affords the criterion. Navigability is not destroyed by occasional natural obstructions, portages, seasonal use, or low stages of water. A river in its natural state having actual navigable capacity, that is, capable of carrying interstate commerce, is within the powers of Congress. Navigability tests must take variations of geography, use, and traffic density into consideration. Navigation appraisals based upon natural ral conditions only are erroneous. 'Natural and or-

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dinary' conditions refers to water volume, gradients, and flow regularity. Permissible limits on artificial aids enabling commercial navigation are a matter of degree. Navigability to fix bed ownerships or riparian rights is determined at statehood. Navigability for commerce may arise later. (Earl-Florida) W71-07880

OPERATION OF RESERVOIR IN INTEREST OF FLOOD CONTROL. Corps of Engineers, Washington, D.C.

33 Code of Federal Regulations, Sec 208.30

Descriptors: *Illinois, *Reservoir operation, *Conduits, *Flood control, Dams, Reservoirs, Reservoir storage, Streamflow, Regulation, Impoundments, Channels, Streams, Water levels, Runoff, Engineering structures, Flow control.

Identifiers: *Alpine Dam and Reservoir.

In the interest of flood control, the city of Rockford, Illinois shall operate the Alpine Dam and Reservoir pursuant to this federal regulation. The opening of the controlled conduit shall be one foot at all times, except that it shall be increased to drain the reservoirs after storage of flood runoff. After such drainage the opening of the conduit shall be reset at its usual level. (Duss-Florida)

OPERATION AND MAINTENANCE OF RESERVOIR PROJECT.

Corps of Engineers, Washington, D.C.

33 Code of Federal Regulations, Sec 208.16 (1970). 3 p, 1 fig.

Descriptors: *Maryland, *Reservoir operation, *Reservoir storage, *Water levels, Administrative agencies, Regulation, Rivers, Streams, Streamflow, Flow control, Maintenance, Dams, Projects, Downstream, Administration, Operation and main-

Identifiers: *Savage River Dam and Reservoir.

The Upper Potomac River Commission through its reservoir operation supervisor shall operate the Savage River Dam and Reservoir pursuant to this federal regulation. The storage of the reservoir shall be regulated to conform with the storage reservation diagram included in the regulation. Releases from the reservoir shall be regulated to maintain downstream flows insofar as possible within prescribed limits. The regulation prescribes operation of the reservoir in the event the reservoir level exceeds a specified level during the spring of each year. This regulation does not require dangerously rapid changes in magnitudes of releases or any action which would reduce water supplies to users below amounts available to them prior to construction of the dam. The project shall be maintained according to maintenance instructions issued by the district engineer of the Corps of Engineers. The operation supervisor shall furnish reports on the dam and hydrological data to the district engineer. These regulations are subject to modification in time of emergency. (Duss-Florida)

OPERATIONS OF THE CORPS OF ENGINEERS UNDER THE FEDERAL POWER ACT.

33 Code of Federal Regulations, Sec 209.140 (1970). 3 p.

Descriptors: *Federal Power Act, *Navigation, *Flood control, *Inter-agency cooperation, Administration, Administrative agencies, Supervisory control (Power), Administrative decisions, Navigability, Federal jurisdiction, Coordination, Integrated control measures, Federal project policy, Federal reservations, Hydroelectric plants, Electric powerplants, Utilities, Permits, Regulation, Navigable rivers, Navigable waters, Water resource development. Identifiers: Administrative regulations.

Under authority of the Secretary of the Army, policies and procedures applicable to Corps of Engineers operations under the Federal Power Act are herin outlined. Such operations are only to be performed upon Federal Power Commission request. Division engineers will serve the Commission as field engineer officers and will conduct field inspections and investigations. Investigation reports on FPC applications affecting navigable waters will include: (1) the desirability of a public hearing concerning pavigation or flood control inhearing concerning navigation or flood control interests; (2) a description of factors bearing on flood control, navigation, and basin water development plans; (3) recommendations on license conditions deemed necessary and coordina-tion with Corps interests; (4) advantages and disad-vantages to the United States where such project is under Department of the Army jurisdiction. Such reports will not be released, nor will copies be furnished to parties, absent specific authority. The supervision of FPC licensed projects will include:

(1) project classification under FPC instructions, (2) monthly inspection of major projects, and (3) postcompletion inspections. The submission of reports by division and district engineers will be governed by requirements contained herein. (Earl-Florida) W71-07964

OPERATION AND MAINTENANCE OF FLOOD PROTECTION WORKS. Corps of Engineers, Washington, D.C.

33 Code of Federal Regulations, Sec 208.10 (1970). 5 p.

Descriptors: *Operation and maintenance, *Flood protection, *Flood control, *Regulation, Adminisprotection, "Flood control, "Regulation, Administrative agencies, Administration, Federal government, State governments, Local governments, Construction, Levees, Engineering structures, Channels, Pumping plants, Floodways, Inspection, Hydrologic data, Drainage, Drainage systems, Rivers, Flow control, Dams, Reservoirs, Benefits, Control, Lead expected. Costs, Legal aspects.

In order to obtain maximum benefits from local flood protection works constructed by the United States, this federal regulation prescribes general and specific methods of operation and maintenance of such structures and facilities. Specific structures covered include: (1) levees, (2) flood walls, (3) drainage structures, (4) closure structures, (5) pumping plants, and (6) channels and floodways. Generally, any state or local agency responsible for the operation and maintenance of flood control works shall appoint a committee headed by a 'superintendent' who shall be responsible for the project during flood periods and for con-tinuous inspection and maintenance during periods of low water--all without cost to the United States. The regulation also prescribes the procedures to be followed in constructing further improvements within project areas. Reports shall be submitted by the superintendent to the district engineer covering inspection, maintenance, and operation of protective works. For the maintenance of specific structures, the regulations require frequent inspections and prescribe specific times when inspections should be made. Measures for maintaining the various structures are enumerated. In order to assure proper functioning and minimize damages, opera-tion of project structures requires continuous patrol during flood periods. A final section of the regulation covers miscellaneous facilities. (Duss-Florida) W71-07984

PORT WARDENS V MARYLAND CAPITAL YACHT CLUB (ADMINISTRATIVE DETERMINATION OF IMPAIRMENT OF NAVIGATION IN RIVER). 273 A2d 102-109 (Ct App Md 1971).

Descriptors: *Maryland, *Boat-launching ramps, *Port authorities, *Administrative decisions, Boats, Navigation, Administrative agencies, Local governments, Permits, Regulation, Legal aspects, Construction, Engineering structures, Riparian rights, Rivers, Bulkheads, Piers, Docks, Breakwaters, Dredging, Channel improvement, Environment engineering, Judicial decisions.

Plaintiff yacht club sought declaratory relief from defendant port warden's denial of permission to build boat slips and related structures and to conbuild boat slips and related structures and to conduct dredge and fill operations in a river. Plaintiff also sought to have the mayor and aldermen's affirmation of the denial declared void. Plaintiff contended that the port wardens could not deny a permit unless they found that navigation would be impaired. Plaintiff also contended that the mayor and alderment ware limited to reviewing the record of aldermen were limited to reviewing the record of the hearing and could not conduct a hearing de novo. Defendant contended that the construction of all of the proposed slips would render navigation too close and confined. The Court of Appeals of Maryland affirmed the trial court's granting of the relief sought and reviewed the evidence in the case. The testimony of witnesses at the port warden's hearing clearly indicated that plaintiff's proposed operation, would not interface. nearing clearly indicated that plaintin's proposed operation would not interfere substantially with navigation. A court may overturn an agency's finding of fact where that finding is deemed to be arbitrary, unreasonable, and capricious. Although additional evidence may have been introduced at the mayor and aldermen's hearing, they had no authority to conduct a de novo hearing. (Smiljanich-Florida)
W71-07987

BOWLEY V OMAHA AIRPORT AUTHORITY (CONDEMNATION VALUE OF LANDS SUB-JECT TO FLOODS). 182 NW2d 911-915 (Neb 1971).

Descriptors: *Nebraska, *Condemnation value, *Floodways, *Land appraisal, Eminent domain, Condemnation, Flood proofing, Flood plain zoning, Levees, Flood protection, Water districts, Flood plains, Missouri River, Channels, Flood control, Land use, Compensation, Industries, Recreation, Rivers, State governments, Administrative agencies, Judicial decisions, Legal aspects, Floods.

Plaintiff landowner sought by eminent domain proceedings to appraise the value of land to be condemned by defendant agency. Plaintiff contended that the land was suitable for industrial purposes and that, although the land was situated in the flood channel of the Missouri River, a levee could be constructed to prevent floods. Plaintiff also contended that he could force the creation of a levee district to construct such a levee. Defendant contended that the land was suitable only for recreational use and sand mining. In affirming a verdict and judgment for defendant's requested valuation, the Supreme Court of Nebraska noted that the land was vulnerable to floods, had poor access to river traffic, and was not in an industrial area. Moreover, evidence was insufficient to show that a new levee would adequately protect plaintiff's land from floods. As to the creation of a levee district, it appeared that many landowners might be affected by such a levee. In addition to the approval of the county board, it would be necessary to obtain a permit under the Flood Plain Act. (Smiljanich-Florida) W71-07988

DURSO V STATE (CONDEMNATION OF PORTION OF LANDOWNER'S SEWAGE SYSTEM). 318 NYS2d 791-793 (App Div 1971).

Descriptors: *New York, *Cesspools, *Condemnation value, *Damages, Eminent domain, Condemnation, Land tenure, Sewage treatment, Sewage disposal, Waste treatment, Domestic wastes, Leaching, Gravity, Sewers, Boundaries (Property), State governments, Damages, Highway relocation, Judicial decisions, Legal aspects.

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Action was brought by plaintiff restaurant owner to recover damages for appropriation of land by defendant state. Plaintiff contended that the condemnation of land by the state included portions of his gravity-type sewage system and that an allowance of \$600 damage by the lower court was inadequate. Defendant contended that only one cesspool of plaintiff's sewage system was appropriated and that the damages awarded were reasonable. In modifying the judgment of the Court of Claims, the Supreme Court of New York, Appellate Division, Third Department, noted that the taking of the condemned land removed one of plaintiff's cesspools and cut across the tile leach lines which led to a substantial dispersal area. Plaintiff's gravity-type sewage system was thus rendered useless. Plaintiff was not entitled to damages for installation of a complicated and sophisticated sewage system, however, but was awarded \$5000 in damages to replace the previous sewer system. (Smiljanich-Florida)

ACT REQUIRING BONDS AS SECURITY FOR DAMAGE TO PUBLIC LANDS BY DRILLING AND MINING.

Florida Laws, ch 69-367, p 1293 (1969).

Descriptors: *Florida, *Public lands, *Drilling, *Mining, State jurisdiction, Damages, Legislation, Oil industry, Mineral industry, Leases, Oil, Gases, Sulfur, Air pollution, Water pollution, Wildlife conservation, Marine animals, Public health, Legal aspects, Administrative decisions, Administrative agencies.

The Trustees of the Internal Improvement Trust Fund shall require a surety or property bond from lessees intending to drill or mine on public lands. The bond shall serve as security and is to be forfeited to the Trustees to pay for any damages caused by the mining or drilling operations. If the drilling or mining will be conducted in the waters of the state, the Trustees shall give special consideration to the extent of such possible damages, including air and water pollution, and destruction of wildlife or marine productivity. (Smiljanich-Florida)

SPECIFICITY REQUIRED IN MINERAL LEASES GRANTED BY STATE AGENCIES. Florida Laws, Ch 69-239, p 942-943 (1969) amending Fla Stat Sec 253.45.

Descriptors: *Florida, *Leases, *Mining, *Administrative agencies, State jurisdiction, Water contracts, Phosphates, Soils, Sands, Clays, Gravels, Lumber, Beaches, Recreation, Drilling, Legislation, Legal aspects.

The trustees of the Internal Improvement Trust Fund, and any other administrative agency having title to or control over any state owned lands, may sell or lease any water, phosphate, soils, timber or minerals in any of the lands other than hard-surfaced beaches used for recreation and certain areas contiguous thereto. The state agencies authorized to grant leases shall specify in each lease the particular minerals the lessee is permitted to drill or mine and the manner in which the same may be extracted. (Smiljanich-Florida) W71-08028

ACT REQUIRING CONSERVATION REPORTS PRIOR TO WORK ON SUBMERGED LANDS. Florida Laws, Ch 69-337, amending Fla Stat Sec 253.1241, p1171-1172 (1969).

Descriptors: *Florida, *Beds under water, *Surveys, *Permits, Dredging, Landfills, Bulkhead line, Submergence, Ownership of beds, Regulation, Investigations, Administrative agencies, Legislation, Legal aspects.

Relating to the regulation of submerged lands and amending a prior act, this legislation requires that certain conservation reports be requested by the Trustees of the Internal Improvement Trust Fund. The Trustees shall request the studies and surveys from the state board of conservation within thirty days after the receipt of an application for sale of submerged land, setting of a bulkhead line or a dredge or fill permit. (Smiljanich-Florida) W71-08034

ACT PROVIDING FOR THREE YEAR EXPIRA-TION DATE ON FILL PERMITS.

TION DATE ON FILL PERMITS. Florida Laws, Ch 69-336, amending Fla Stat Sec 253.124 (4) p 1170-1171 1969.

Descriptors: *Florida, *Landfills, *Permits, *Beds under water, Operations, Regulation, Environmental engineering, Public lands, Administrative decisions, Administrative agencies, Legislation, Adjudication procedure, State jurisdiction, Legal aspects. Identifiers: Expiration dates.

Amending and clarifying an existing act, this legislation provides that a fill permit, which shall be issued by the Trustees of the Internal Improvement Fund only if the proposed work is to be completed within three years, shall expire three years after the issuance of the fill permit. Such time may be extended for additional periods of up to three years by the Trustees for good cause, upon a showing that all due efforts and diligence toward completion of the work have been made. Provision is made for revocation of permits for non-compliance or violation of their terms. Judicial review of such revocation is also provided (Smiljanich-Florida) W71-08040

TITLE TO SUBMERGED LANDS AND RESTRICTIONS ON BULKHEAD LINES AND FILLING AND DREDGING.

Florida Laws, Ch 69-308, amending Fla Stat Sec 253.12 (1), p 1112 (1969).

Descriptors: *Florida, *State jurisdiction, *Dredging, *Ownership of beds, Beds under water, Land tenure, Islands, Sand bars, Banks, Federal government, Landfills, Coasts, Navigable waters, Lakes, Navigable rivers, Streams, Bulkhead line, Permits, Administrative agencies, Legislation, Legal aspects.

The Trustees of the Internal Improvement Trust Fund are vested with title to all sovereignty submerged lands, including: (1) all islands, sand bars, shallow banks and small islands made by the dredging of any channel by the United States government; (2) sand bars and shallow banks located in the navigable waters; (3) all coastal and intracoastal waters of the state; and (4) all submerged lands owned by the state by right of its sovereignty in navigable freshwater lakes, rivers and streams, except submerged lands conveyed by prior deed or statute. Submerged land in navigable freshwater lakes, rivers and streams are hereby included within restrictions relating to bulkhead lines and filling and dredging of submerged lands. (Smiljanich-Florida) W71-08041

LOUISIANA SOUTHERN RY V BOARD OF LEVEE COMM'RS (LIABILITY OF STATE FOR FLOODING OF LANDS BY LEVEE). 176 La 687, 146 So 470-472 (1933).

Descriptors: *Louisiana, *Levees, *Flooding, *Damages, Flood damage, Submergence, Floodwater, State jurisdiction, Flood control, Compensation, Net income, Profit, Land use, Government finance, Legislation, Judicial decisions, Legal aspects, Administrative decisions, Remedies.

Plaintiff railway sued defendant board of levee commissioners for loss of revenue due to flooding of plaintiff's lands. The flooding was caused by an artificial break in defendant's levee. Plaintiff contended that defendant had assumed liability for the intentional act and therefore should pay for loss of plaintiff's revenue while its lands were covered with water. Defendant contended that the statute authorizing payment of damages limited such damages to the injury to physical property. In affirming a dismissal of the suit by the lower court, the Supreme Court of Louisiana noted that the state has the right of determining the propriety, location, and mode of building levees. Whatever damages are caused to others in the exercise of this right are non-compensable without voluntary assumption of liability. Defendant had accepted liability limited to physical damages, and plaintiff was therefore not allowed to recover for consequential injuries. (Smiljanich-Florida) W71-08054

PALMER CORPORATION V COLLINS (CONTAMINATION OF OIL BY WATER SEEPAGE FROM NEGLIGENTLY ABANDONED OIL WELL).

214 Ky 838, 284 SW 95-98 (1926).

Descriptors: *Kentucky, *Oil wells, *Groundwater, *Seepage, Drill holes, Oily water, Groundwater movement, Oil-water interfaces, Impervious soils, Groundwater barriers, Infiltration, Oil, Oil reservoirs, Drilling equipment, Leases, Damages, Land tenure, Judicial decisions, Legislation, Legal aspects.

Plaintiff leaseholder sued defendant corporation for damages caused by defendant's failure to adequately plug up abandoned oil wells. Plaintiff contended that the abandoned wells allowed water to seep into the oil-bearing stratum, thus contaminating plaintiff's oil with water. Defendant contended that plaintiff had not sufficiently proven that the water came from defendant's abandoned wells. Defendant also contended that a statute authorizing plaintiff to go on defendant's land and plug up the wells and then maintain an action against defendant to recover the cost precluded the plaintiff from additionally seeking damages to his oil. The Court of Appeals of Kentucky, in affirming the lower court judgment for plaintiff, noted that water had not appeared in plaintiff's oil until defendant's wells were abandoned and subsequently found to contain water. The statute authorizing plaintiff to prevent future damages did not preclude his right to recover for the past injury incurred by the water. To destroy the production of oil is to destroy property, allowing the owner to recover damages thereby sustained. (Smiljanich-Florida)

GIBSON V MADDEN (BOUNDARY DISPUTE REGARDING MEANDER OF STREAM AND ADVERSE POSSESSION).

229 Ky 273, 17 SW2d 263-266 (1929).

Descriptors: *Kentucky, *Boundary disputes, *Meanders, *Prescriptive rights, Boundaries (Property), Streams, Riparian lands, Land tenure, Watercourses (Legal), Riparian rights, Banks, Judicial decisions, Remedies, Thalweg, Channels, Legal aspects.

Identifiers: *Adverse possession.

Plaintiff brought action against defendant to quiet title to a disputed strip of land. Plaintiff contended that a boundary line described in a deed as being drawn 'up the creek' meant that the boundary line followed the center of the creek with its meanders. Plaintiff alternatively contended that he had obtained title to the land through adverse possession. Defendant contended that the disputed boundary line was meant to be a straight line not following the thread of the stream and that he had given plaintiff permission to use the land in question, thus precluding adverse possession. The Court of Appeals of Kentucky, affirming a judgment for defendant, noted that the context of the deed indicated that a straight line was the true boundary of the property. The defendant, therefore, had title to the land and had given his permission for plaintiff to

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use the land. No prescriptive title to a contested strip of land is established through use where such use is with the owner's permission. (Smiljanich-Florida) W71-08057

DERMIT V SERGEANT BLUFF CONSOL INDEPENDENT SCHOOL DIST (DUTY TO PROVIDE CHOOL TRANSPORTATION DESPITE AVUL-SION OF RIVER).

261 NW 636-637 (Iowa 1935).

Descriptors: *Iowa, *Avulsion, *Schools (Education), *Boundaries (Property), Missouri River, Boundary disputes, Transportation, Reimbursable costs, Contracts, Rivers, Administrative agencies, State governments, State jurisdiction, Legislation, Judicial decisions, Legal aspects.

Plaintiff landowner sued defendant school district For the cost of transporting his children to school. Plaintiff contended that a shift in the Missouri River caused plaintiff's lands to be on the opposite side of the river but still within the state. Plaintiff also contended that defendant agreed to pay tuition for plaintiff's children to attend school in the neighboring state but thereafter refused to pay for the transportation to such school. Defendant contended that it was not required to provide transportation to schools in another state as it had not entered into a contract with plaintiff to do so. In affirming the trial court award to plaintiff for the cost of transporting his children, the Supreme Court of lowa noted that the avulsion of a river does not shift state boundaries. As plaintiff's lands were still within the state, the school district was obligated by statute to provide school transportation for his children. The agreement to send the children to the neighboring state's schools carried with it the duty of the school district to pay for the transportation involved. (Smiljanich-Florida) W71-08075

NORTHRUP V CITY OF JACKSON (ABATE-MENT OF MUNICIPAL WASTE POLLUTION AND DAMAGES). 273 Mich 20, 262 NW 641-644 (1935).

Descriptors: *Michigan, *Municipal wastes, *Water pollution, *Remedies, Rivers, Cities, Riparian land, Riparian rights, Reasonable use, Damages, Sewage disposal, Waste dumps, Sewage treatment, Pollution abatement, Treatment facilities, Water pollution effects, Relative rights, Riparian waters, Local governments, Legislation, Judicial decisions, Legal aspects. Identifiers: *Nuisance.

Plaintiff riparian landowner sued defendant city seeking damages and an injunction. Plaintiff contended that defendant's raw sewage was emptied into a river bounding plaintiff's land, thus polluting the river and creating a nuisance. Plaintiff also contended that defendant's sewage system was not a governmental function but was a private or proprietary function. Defendant contended that a provision in the city charter required plaintiff to present his claim to the city as a prior condition to bringing suit, which the plaintiff had failed to do. In affirming the injunction granted by the lower court but reversing an award for past damages, the Supreme Court of Michigan held that the charter provision requiring prior presentment of claims to the city was valid as applied to damages incidental to abatement of a nuisance. The court noted that a sewage system is a necessary city function which is public in character and therefore a governmental exercise protected by charter provisions. (Smiljanich-Florida) W71-08079

STATE EX REL BUCKSON V PENNSYLVANIA RR (DETERMINATIONS BY PRIOR SURVEYS OF LOCATION OF MEAN LOW WATERLINE).

273 A2d 268-271 (Del 1971).

Descriptors: *Delaware, *Low water mark, *Boundaries (Property), *Landfills, Water level fluctuadaries (Property), "Landfills, Water level fluctua-tions, Riparian rights, Delaware River, Boundary disputes, Geological surveys, State governments, Railroads, Core drilling, Rivers, Banks, Water levels, Average, Measurement, Variability, Ripari-an land, Judicial decisions, Legal aspects, High

Plaintiff attorney general sought a declaratory judgment to determine title and related rights to certain foreshore between high and low water marks on a river. Plaintiff contended that defendant's filling operation extended beyond the mean low waterline. Plaintiff also contended that surveys made in 1942 and 1954 as to location of the mean low waterline were adequate in determining its location in 1964, when the filling operation was commenced. Plaintiff alternatively requested that the case be remanded to permit the state to make geological examinations of core drillings in order to establish the natural mean low waterline. Defendant contended that surveys made in 1967, after the filling operation ceased, were the only adequate evidence as to the location of the mean low waterline. In affirming the lower court judgment for defendant, the Supreme Court of Delaware noted that the surveys taken in 1942 and 1954 were inadequate to accurately demarcate the mean low waterline of 1964. The state's request for a new determination, made five years after the companion of the action, was not timely and theremencement of the action, was not timely and therefore rejected. The survey of 1967 was the only adequate evidence as to the waterline's location. (Smiljanich-Florida) W71-08113

NEW RIVERS AND OLD REALITIES: WHY WESTERNERS DISAGREE ABOUT SHARING THEIR WATER WEALTH, Department of Environment, Ottawa (Ontario).

Prairie Region Water Planning. Frank J. Quinn.

Arizona Review, Vol 20, No 4, Apr 1971. 9 p.

Descriptors: *Inter-basin transfers, *Arid lands, *Planning, *Beneficial use, Environmental effects, Evaluation, Political aspects, Legal aspects, Social aspects, Water resources development, Surface waters, Rivers, Canada, Southwest U.S., Pacific Northwest U.S.

This is a discussion of manipulation of water resources for interbasin transfer. The Southwest contends with an imbalance between growing population and dwindling water resources. Obvious solutions such as reallocation of existing water rights to guarantee beneficial use and recycling require complicated political maneuvering which is often unsuccessful. In fact, no man-made water diversions now cross major political boundaries. In the past, surplus parts of a basin have supplemented deficit parts of the same basin. Water is different from other resources, often coming free with property, and is allocated by differing state governments. One user may affect many other users. Some current thoughts on interbasin transfer follow: Water transfers on a large scale of necessity would create large-scale environmental disturbances. Efficiency based arguments state that water should go to the highest bidder, or where it is most valuable. Equitable-sharing proponents use the amount of so-called 'progress' or social benefits gained, to evaluate systems of water use. Environmental thinkers advocate comprehensive planning and thorough preliminary studies before interbasin transfer is to be attempted. The problem must be viewed as a national, rather than a regional struggle. (Yensen-Arizona) W71-08145

RIVER BASIN MONETARY AUTHORIZATION AND MISCELLANEOUS CIVIL WORKS

AMENDMENTS ACT OF 1970.
Public Law No 91-282, 84 Stat 310, 6 US Code Cong and Admin News, p 1837-1840 (1970). 4 p.

Descriptors: *River basin development, *Government finance, *Project planning, *Projects, Legislation, River basins, Flood control, Planning, Water resources development, Financing, Budgeting, Allotments, Federal government, Water supply, Water storage, Water management (Applied), National parks, Dams, Hydroelectric plants, Reservoirs, Water rights, Pumped storage, Barriers, Fish hatcheries, Legal aspects.

Pursuant to previous acts authorizing various public water projects, Congress herein authorizes additional appropriations for prosecution of these projects. The projects so affected include: various comprehensive river basin plans; and the central and southern Florida comprehensive plan for flood control, including water supply requirements for the Everglades National Park. Congress also modi-fies various other public water projects to include: (1) the construction of local protection works in a flood control project in Ohio; (2) authorization to include the construction of a pumped storage development in the comprehensive development plan of the Delaware River Basin; (3) the construction, operation, and maintenance of fish hatchery facilities in Montana; and (4) authorization for a city to construct a barrier dam across a lake in Texas, provided that the city obtain any necessary state water rights. (Smiljanich-Florida) W71-08157

INTERNATIONAL, NATIONAL AND STATE ELEMENTS OF OCEANS AND COASTAL ZONE MANAGEMENT, California Advisory Commission on Marine and

Coastal Resources.

Robert B. Brueger.

Oceans 71 Conference, Mar 11, 1971, Long Beach, California. 17 p.

Descriptors: *Oceans, *Water management, *Water policy, *Water resources development, *Legislation, International waters, International law, Coasts, Seas, Regulation, Planning, Political aspects, State governments, Federal government, Colifornia

Identifiers: Global oceans management.

Oceans management is a global issue, with state, national and international policies having global effects. Five essential guidelines for a global oceans management system are presented, with emphasis on concomitant political realism. International progress is being made, as demonstrated by the establishment of the U.N. Seabeds Committee, a 1973 U.N. Conference on ocean issues, and a 1972 U.N. Conference on the Human Environment. U.S. federal regulation and policy development for ocean management is explored with references to the River and Harbors Act of 1899, the Refuse Act of 1899, the 1953 Outer Continental Shelf Lands Act, the National Environmental Policy Act of 1969, and the proposed National Coastal and Estuarine Zone Management Act of 1971. Lack of state regulation and policy of coastal uses is discussed. The development of the California coastal zone management system is presented in detail, with a discussion of several conservation acts and commissions, and emphasis on the proposed establishment of a state-wide coastline regulatory scheme. (McEntyre-PAI) W71-08158

AN ACT PROVIDING A SETBACK LINE FOR COASTAL CONSTRUCTION AND EXCAVA-TION; THE GRANTING OF VARIANCES, AND PENALTIES.

Florida Laws, Ch 70-231, p 674-677 (1970) amending Fla Stat Ch 161.

Descriptors: *Florida, *Beach erosion, *Erosion control, *Coastal structures, Non-structural alternatives, Legislation, Legal aspects, Coastal engineering, Excavations, Sea walls, Shore protection, Specifications, Supervisory control (Power), Constraints, Adoption of practices, Real property,

Field 06—WATER RESOURCES PLANNING

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Riparian land, Beaches, Administration, Administrative decisions, State governments, Construction, Administrative agencies, Washouts.

No person, firm, corporation, or public agency shall construct any dwelling, hotel, motel, apartment, sea wall, revetment, or incidental or related structures within fifty feet of the mean high water line of riparian coastal locations. This amendment to existing legislation encompasses the Gulf of Mexico and Atlantic shorelines exclusive of bays, inlets, rivers, bayous, creeks, and passes. Setback waiver or variance may be authorized by the Department of Natural Resources: (1) upon facts clearly justifying waiver on variance; (2) if existing structures have established a reasonably continuous, closer construction line not affected by erosion; and (3) for the construction of non-eroding pipelines and piers. Structures or excavations violating this section are hereby declared a public nuisance. The Department of Natural Resources may remove such nuisance after failure to comply with written notice. All costs shall constitute a lien upon the property. Each month of violation shall constitute a separate offense punishable by not less than \$500, nor more than \$1000. This section shall not apply to existing structures, structures under construction, or shore protection structures. The Department may specifically exempt coastline areas not subject to substantial erosion. (Earl-W71-08174

INTERNAL IMPROVEMENT TRUST FUND (TRUSTEES GIVEN POWER OF EMINENT DOMAIN OVER SUBMERGED LANDS). Florida Laws Ch 70-358, p 1139 (1970) amending

Fla Stat Sec 253.02. 1 p.

Descriptors: *Florida, *Eminent domain, *Beds under water, *Administrative agencies, Beds, Legislation, Condemnation, Land, Land tenure, Navigable waters, Legal aspects.

Amending portions of existing Florida statutes relating to the Board of Trustees of the Internal Improvement Trust Fund, this act provides the Board with the power of eminent domain over submerged lands. Certain lands are excluded from this power. The Board shall be a necessary party in eminent domain proceedings involving submerged lands and lands under navigable waters. (Duss-Florida) W71-08177

AN ACT RELATING TO THE BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT FUND, PROHIBITING THE ISSUANCE OF AFTER-THE-FACT CONSTRUCTION PER-MITS.

Florida Laws ch 70-116, p 429-430 (1970) amending Fla Stat sec 253.124.

Descriptors: *Florida, *Administrative decisions. *Permits, *Landfills, Land development, Land use, Administration, Adoption of practices, Administrative agencies, Environmental effects, Conservation, Real property, Supervisory control (Power), Environment, Constraints, Legislation, Legal aspects, Marine plants, Coastal engineering, State govern-

The Board of Trustees of the Florida Internal Improvement Fund shall in no case issue after-the-fact construction permits for the filling of land. Upon consideration of a report by the Department of Natural Resources, however, such a permit may be granted where the Board finds that any other remedy available to it would be more damaging to the environment or marine resources. The granting of such permits shall not absolve applicants from the provisions of subsection five of this section. (Early-Florida) W71-08200

INTERNAL IMPROVEMENT TRUST FUND (AMENDMENT TO LAW RELATING TO DREDGING AND FILLING).

Florida Laws ch 70-167, p 540-542 (1970) amending Fla Stat sec 253.123.3 p.

Descriptors: *Florida, *Dredging, *Navigable waters, *Bulkheads, Legislation, Pumping, Navigation, Channels, Beach erosion, Sands, Administrative agencies, Administration, Landfills, Legal aspects, Beaches, Shores. Identifiers: *Bulkhead lines.

Amending existing Florida statutes relating to restrictions on filling land and dredging beyond bulkhead lines, this act provides two things. First, it extends existing restrictions on the removal of material from certain navigable waters to apply to waters landward as well as channelward of bulkhead lines. Secondly, the act eliminates an exception to the general prohibition against removal of sand, rock or earth from navigable waters by dredging, pumping, digging or other means. Specifically, no longer will such removal be permitted for the replenishment of eroded beaches or for the prevention or reduction of beach erosion. (Duss-Florida) W71-08201

INTERNAL IMPROVEMENT TRUST FUND (PERMITS RELATING TO THE FILLING OF LAND).

Florida Laws Ch 70-333, p 973-974 (1970) amending Fla Stat Sec 253.124.

Descriptors: *Florida, *Permits, *Coastal structures, *Riparian land, Navigable waters, Bulkheads, Sea walls, Shore protection, Retaining walls, Erosion, Avulsion, Administrative agencies, Administration, Legislation, High water mark, Construction, Ecology.

Amending an existing Florida statute relating to the filling of land, this act requires riparian upland owners bordering navigable waters to obtain a permit before rebuilding, replacing, repairing or reconstructing certain coastal structures. Coastal structures covered include seawalls, retaining walls, revetments, bulkheads or other similar structures. Permits shall be issued by the authorized local or county body. Permits are subject to the approval of the Board of Trustees of the Internal Improvement Trust Fund and are not valid without approval. The Act outlines circumstances under which riparian owners may be exempt from submitting biological and ecological studies concerning the effects of their proposed work. (Duss-Florida)

FLORIDA AIR AND WATER POLLUTION CONTROL ACT (ASSESSMENT OF DAMAGES TO FISH POPULATIONS).

Florida Laws Ch 70-141, p 488 (1970) amending Fla Stat Sec 403.141.

Descriptors: *Florida, *Water pollution control, *Damages, *Fishkill, Water pollution, Conservation, Fish, Administrative agencies, Regulation, Wastes, Fish populations, Legislation, Ecology, Aquatic environment, Administration, Standards

Amending an existing Florida statute relating to assessment of damages against polluters whose discharges into waters damage fish populations. this act provides that a table of values for individual categories of fish shall be utilized in assessing such damages. The Department of Air and Water Pollution Control shall promulgate such table of values and shall utilize existing values established by the Department of Natural Resources and the Game and Fresh Water Fish Commission. (Duss-Florida) W71-08203

LEGAL ASPECTS PERTAINING TO ENVIRON-MENTAL REGULATIONS IN PORK PRODUC-

Missouri Univ., Columbia. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 05G.

THE REFUSE ACT OF 1899: NEW TASKS FOR N OLD LAW,

William C. Steffin. Hastings Law Journal, Vol 22, No 3, p 782-804 (1971). 23 p, 156 ref.

Descriptors: *Rivers and Harbors Act, *Water pollution control, *Pollution abatement, *Waste disposal, Legislation, Non-structural alternatives, Permits, Judicial decisions, Federal government, Federal jurisdiction, Water quality control, Water pollution, Water pollution sources, Effluents, Industrial wastes, Administration, Legal aspects, Navigable waters, Administrative agencies, S visory control (Power), Regulation, Adjudication

Known as the Refuse Act, Section 13 of the Rivers and Harbors Act of 1899 prohibits the discharge of refuse into navigable waters without a permit. This note considers utilization of the Refuse Act as a water pollution control device. Contemporary abatement devices, because of restrictive judicial doctrines or ineffective statutory enforcement procedures, are inadequate. In the author's view, the Refuse Act overcomes a number of existing abatement barriers. Broad judicial interpretation and the Act's recently implemented discharge-permit system make it applicable to most water pollution violations. Enforcement procedures under the Act are detailed. The Justice Department's reluctance to exercise its enforcement authority is analyzed and critized. Injunctive relief and criminal sanctions are available under the Act. The possibility of extending injunctive relief to future discharges and the removal of past discharges is discussed. The nature and utilization of qui tam actions is examined. The effectiveness of enforcement procedures on a class of pollutors is considered in terms of specific case histories. The author concludes that the Act is a valuable pollution control tool which could become more valuable with an effectively administered permit system. (Earl-Florida) W71-08228

THE LEGAL STATUS OF ARTICLES 1-3 OF THE CONTINENTAL SHELF CONVENTION ACCORDING TO THE NORTH SEA CASES, Myron Nordquist.

California Western International Law Journal, Vol 1, No 1, p 60-79 (1970). 20 p, 81 ref.

criptors: *International law, *Continental Shelf, *Beds under water, *Regime, United Nations, Judicial decisions, Treaties, International waters, Boundary disputes, Legal aspects, Jurisdiction, International commissions, Foreign countries, Law of the sea, Beds, Political aspects, Exploitation. Administration.

As interpreted in the North Sea Continental Shelf Cases, the status of Articles 1-3 of the Continental Shelf Convention is evaluated in this article and related to present attempts to regulate international sea-bed areas. The principles and rules of law set forth in the North Sea Cases are reviewed by the author. Although the customary law status of Articles 1-3 were not ruled upon in the North Sea Cases, the author scrutinizes both the majority and dissenting opinions for indications of that status. After focusing particular attention upon Article One, the author concludes that Articles 1-3 would be integral components of any Continental Shelf regime. The view that these articles are customary law is supported by state practice patterned after these articles. If Articles 1-3 are in fact customary law, their effect upon newly negotiated treaties must be carefully weighed. Rights obtained under

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the exploitation clause of Article One would conflict with the Draft Convention on the International Sea-Bed Area submitted by the United States. Fortunately, no perfected exploitation claims exist, and there is still time to rationally develop a seabed regime. Accelerated technological advances, however, indicate the time for rational development may be running out. (Earl-Florida) W71-08229

MICHIGAN ENVIRONMENTAL PROTECTION

Susan Pearce.

Journal of Law Reform, Vol 4, No 1, p 121-134 (1970). 14 p, 66 ref.

Descriptors: *Michigan, *Water quality control, *Water pollution control, *Environmental effects, Pollution abatement, Legislation, Water policy, Judicial decisions, Legal aspects, Adjudication procedure, Public rights, Water quality, Water resources, State governments, State jurisdiction, Non-structural alternatives, Balance of nature, Remedies, Relative rights, Social values.

Identifiers: *Michigan Environmental Protection

Identifiers: *Michigan Environmental Protection Act of 1970.

The substance, common-law roots, and potential functioning of the Michigan Environmental Protection Act are examined in this note. The Act ex-plicitly recognizes and expands a legal interest in environmental protection, enforceable through state or private litigation. A procedural framework is established for the assertion of this right in judiis established for the assertion of this right in judicial proceedings. The author evaluates the Act in terms of: (1) the legal basis for the environmental right afforded, (2) review of administrative proceedings., (3) the Act's lack of judicial standards, (4) the variety of actions and remedies available under the Act, and (5) the protection afforded indirect Continuous and actions. forded indigents. Constitutional questions arising from the Act are examined. The direct judicial consideration of environmental issues allowed by the Act's removal of barriers to private environmental actions are evaluated. Implicit recognition that environmental protection requires a balancing of competing interests is contained in the Act's variety of enforcement actions. The absence of monetary awards may be only partially cured by the provision authorizing class actions. Although a needed alternative to prior legislative and adminis-trative remedies is provided, the Act's flexibility makes its potential effectiveness difficult to predict. Early cases must be well defined to insure the orderly development of judicial standards. (Earl-Florida) W71-08230

EFFLUENT CHARGES: WATER POLLUTION

CONTROL, Giovanna M. Longo. Journal of Law Reform, Vol 4, No 1, p 47-62 (1970). 16 p, 67 ref.

Descriptors: *Water pollution control, *Water quality control, *Economic justification, *Cost allocation, Effluents, Real costs, Total costs, Water policy, State governments, Federal government, Local governments, Legislation, Non-structural alternatives, Pollution abatement, Water pollution, Environmental sanitation, Administration, Administrative agencies, Judicial decisions, Legal aspects, Water users, Economics, Feasibility studies, Resource allocation, Waste disposal. Identifiers: *Water Quality Act of 1965, Effluent-

charge systems.

Recognizing the gravity of the national water-pollution problem, this note examines the necessity and constitutionality of effluent charge systems. In the author's view, water pollution exists because water is an underpriced commodity. Under an effluent-charge system the total cost of each unit of water, including pollution costs, are assigned to each user. Water quality standards promulgated under the Water Quality Act of 1965 have failed to encompass the total-cost concept. Institutional arrangements for administration effluent charges are comments for administration effluent charges are compared at the federal, state, and local level. In the author's view, practical and political problems dictate that effluent systems be administered at the state level. The constitutionality of state-administered effluent charges are analyzed in relation to: (1) prohibitions against special commissions, (2) municipal home rule provisions, and (3) indebtedness limitations. To successfully implement an effluent-charge system, the author concludes that each state should adopt legislation: (1) vesting in the state ownership or control of all public water resource facilities; (2) establishing an agency with comprehensive water planning, development, and management authority; and (3) allowing actions by private attorneys general against such an agency. (Earl-Florida) W71-08231

THERMAL POLLUTION: THE ELECTRICAL UTILITY INDUSTRY AND SECTION 21 (b) OF THE FEDERAL WATER POLLUTION CON-TROL ACT, Russell L. Johnson.

Hastings Law Journal, Vol 22, No 3, p 685-704 (1971). 20 p, 160 ref.

Descriptors: *Thermal pollution, *Electric power industry, *Water quality control, *Water pollution control, Federal government, Legislation, Legal aspects, Judicial decision, Pollution sources, Electric powerplants, Thermal water, Water pollution, Nuclear powerplants, Pollution abatement, Temperature, Environmental effects, Administration Nuclear powerplants, Foliution aoatement, temperature, Environmental effects, Administration, Adoption of practices, Administrative agencies, Administrative decisions, State governments, Cooling waters, Thermal conductivity, Ecology, Supervisory control (Power).
Identifiers: *Federal Water Pollution Control Act,

*Water Quality Improvement Act of 1970.

The Water Quality Improvement Act of 1970 (W-QIA) was enacted to control thermal pollution by electric utilities. Evaluated in this note is the Act's impact in relation to the environmental problems created by thermal pollution. Water quality standards and enforcement procedures under the Federal Water Pollution Control Act (FWPCA) have not adequately protected the aquatic environment from nuclear and fossil fuel generating plants. A case study is utilized by the author to demonstrate that the FWPCA does not allow preventative regulation of thermal pollution. Section 21 (b) of the WQIA was intended to fill this regulatory gap. The act requires certification to the appropriate rice are requires certain to the appropriate federal agency that existing water quality standards will not be violated. WOIA certification procedures, compliance checks, and licensing agency jurisdiction are evaluated. The substantive weaknesses of Section 21 (b) are evaluated. Such weaknesses include: (1) the absence of public hearings, (2) inadequate regulation of fossil-fuel plants, and (3) the inadequacy of related water quality standards. Despite such weaknesses the WQIA is a major step in the preventative control of thermal pollution. (Earl-Florida) W71-08232

THE NORTH SEA CONTINENTAL SHELF CASES--A RAY OF HOPE FOR THE INTERNATIONAL COURT,

L. F. E. Goldie.

New York Law Forum, Vol 16, No 2, p 325-377 (1970). 53 p, 189 ref.

Descriptors: *International law, *Continental Shelf, *Judicial decisions, *International commissions, Boundary disputes, Boundaries (Property), United Nations, Jurisdiction, Foreign countries, Foreign waters, Beds under water, Regime, Regulation, Administration, Treaties, Political aspects, Law of the sea, International waters, Oil industry, Legal aspects, Exploitation.

The North Sea Continental Shelf Cases are evaluated in this article in relation to their effect upon the role of the International Court of Justice. The

Court's holding in these cases, based in part upon the Continental Shelf Convention and in part upon an international 'duty to negotiate' over lapping continental shelves, is examined in terms of: (1) the facts of the dispute, (2) arguments presented, (3) equity and distributive justice principles, and (4) the 'natural prolongation doctrine' and equidistance principle. The author relates customary international law on the Continental Shelf to: (1) ry international law on the Continental Shelf to: (1) the formation and formative organs of international law, (2) proposed principles of international common law, and (3) the court's view of the customary law status of the Continental Shelf Doctrine. The source, significance, and development of the international obligation to bargain in good faith are considered, along with objections thereto. Alternative Continental Shelf regimes are discussed in light of: (1) goals. (2) areas. (3) participants, and (4) mea-(1) goals, (2) areas, (3) participants, and (4) measures. The agent state model administrative conciliation, and multi-national public enterprises are considered as alternative regimes. The author concludes that the North Sea decision may afford a means of restoring the court to a central position in the international legal order. (Earl-Florida)

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT TO CHANGE THE TREATMENT WORKS CONSTRUCTION PROGRAM.

Senate Bill 1092, 89th Cong, 1st Sess (1965).

Descriptors: *Water pollution treatment, *Treatment facilities, *Construction costs, *Grants, Allotments, Financing, Projects, Administration, Project planning, Water pollution control, Pollution abatement, Water quality control, Cost allocation, Administrative, accepting Government Finance Administrative agencies, Government finance, Federal government, Human population, Urbanization, Cities, State governments, Legislation, Legal

Provisions of the Federal Water Pollution Control Act regarding treatment works construction pro-Act regarding treatment works construction programs would be amended by this bill to delineate the limitations on federal grants and to allot federal sums appropriated pursuant to the Act. No federal grant would be made for any project under the Act unless such project shall have been approved by the appropriate state water pollution control agency and by the Secretary, and unless such project is included in a comprehensive program developed purely cluded in a comprehensive program developed pursuant to the Act. Such grants would not exceed 30 per centum of the estimated reasonable cost of the treatment works. The projects must be in conformity with the state water pollution control plan and must satisfactorily assure proper and efficient operation and maintenance of the treatment works. Sums appropriated pursuant to the Act would be allotted both on the basis of the total state population and on the basis of the state urban population.

Any state failing to use allocated funds for lack of projects would, subject to certain restrictions, have those funds reallocated to other states. (Smiljanich-Florida) W71-08234

MARINE EXPLORATION AND DEVELOP-MENT ACT. Senate Bill 1091, 89th Cong, 1st Sess (1965).

Descriptors: *Continental Shelf, *Water resources development, *Exploitation, *Exploration, Mining engineering, Oceans, Water resources, Marine geology, Beds, International waters, International law, Treatics, Federal jurisdiction, Coasts, Environmental engineering, Surveys, Mapping, Financing, Grants, Loans, Institutions, Industries, Federal government, Administrative agencies, Legislation, Legal aspects.

The Marine Exploration and Development Act would provide a program of marine exploration and development of the resources of the Continental Shelf. The United States would assume responsibility for programs of exploration and development of the resources, pursuant to rights obtained under

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the Convention on the Continental Shelf, through encouragement of private investment and dis-semination of information. A Marine Exploration and Development Commission would be established. The Commission would formulate and carry out programs for purposes of exploration and development of the marine resources of the Continental Shelf and its waters, including programs for expeditions, surveys, and development of an en-gineering capability for exploitation of the marine resources. The Commission would be authorized to resources. The Commission would be activated to enter into agreements with other government agencies and with public or private scientific institutions or enterprises for the carrying out of activities authorized by this Act. A Marine Exploration and Development Fund would be established to provide loans or grants authorized by this Act to public or private scientific institutions or business enterprises. Provisions for monetary appropriations and dissemination of information would also be made under the Act. (Smiljanich-Florida) W71-08235

CONSERVATION DIRECTORY 1971. National Wildlife Foundation.

The National Wildlife Foundation, Wash, DC (1970), 152 p, 2 append.

Descriptors: *Administrative agencies, *Organizations, *Institutions, *Conservation, Natural tions, *Institutions, *Conservation, Natural resources, Professional societies, Technical societies, Personnel, Management, Leadership, Occupations, Classification, Publications, Information retrieval, Universities, History, Engineering personnel, Professional personnel, Scientific personnel, Water resources, Administration, Federal government, State governments, Local governments, Legal aspects.
Identifiers: *Directories.

Agencies, committees, organizations and officials concerned with natural resource use and management are listed in this directory, including relevant information such as their general purposes and organization, and the addresses, phone numbers and names of their officials. Among the organizations listed are: (1) congressional committees; (2) federal executive departments; (3) federal independent agencies; (4) international, national and interstate governmental commissions; (5) international, national and interstate private organiza-tions; (6) state and territorial governmental agencies and private citizens groups, listed by state and territory; and (7) Canadian provincial territorial agencies and citizens groups. A list of major colleges and universities offering professional training for a career in natural resources management and a listing of fish and game commissioners and directors of the United States and Canada are appended, along with a list of periodicals of interest. (Smiljanich-Florida) W71-08236

WATER FOR WESTSTATE, USA: THE ASSOCIATION IN THE POLITICS OF WATER RESOURCE DEVELOPMENT, Eddie B. Eiselein.

Dept of Anthropology, Univ of Arizona (1969). 271 p, 27 fig, 18 tab, 136 ref, 1 append.

Descriptors: *Water resources development, *Decision making, *Political aspects, *Organizations, Southwest US, Institutions, Conservation, Social aspects, Water policy, Water resources, Institutional constraints, State government, Local governments, Recreation, Cooperation, Interstate, Parropeal Local aspects, Water Personnel, Leadership, Legal aspects, Water management (Applied). Identifiers: *Associations.

Water resources development in the American West is partially dependent upon a political process of decision-making. This political process is viewed by this dissertation as a system composed of various social units, and it is examined through the activities of one type of social unit--the formal voluntary

association. Eight associations were studied over a period of eighteen months. Each of the associations was examined with regard to its structure and activities in water resource development, including: (1) the internal organization of the association, (2) the relationship of the association with the wateroriented power structure of the state, (3) the interrelationships with the other social units of the system, (4) the problems of associational success and failure, and (5) function of the association in the internal maintenance of the system and its out-put. The associations were found to decrease the potential for cooperation in many respects, yet did provide an informal and non-public setting for compromise and decision-making. The interdependency of the associations is discussed, along with the distribution of power throughout the system, particularly between the public and private sectors. (Smiljanich-Florida) W71-08237

TEMPORARY CLOSURE OF WATERWAYS TO NAVIGATION; REMOVAL OF WRECKS AND OTHER OBSTRUCTIONS.

Corps of Engineers, Washington, D.C.

33 Code of Federal Regulations, Secs 209.180, 209.190 (1970). 4 p.

Descriptors: *Navigation, *Navigable waters, *Rivers and Harbors Act, *Federal jurisdiction, Navigable rivers, Accidents, Hazards, Safety, Adoption of practices, Administration, Administra tive agencies, Federal government, Supervisory control (Power), Channel improvement, Canals, Harbors, Ships, Legislation, Legal aspects, Judicial decisions, Administrative decisions, Construction,

Identifiers: Administrative regulations.

Herein promulgated by the Secretary of the Army are procedures applicable to the closing of, or removal of obstructions from, navigable waterways. Factors to be evaluated in authorizing the temporary closing of a navigable waterway include: effects on navigation, times and duration of the closing, and necessity. Where no question as to necessity or propriety exists, the District Engineer may inform an applicant that the Department of the Army will not object for a stated period of time. All other cases will be forewarded to the Chief of Engineers. Section 8 of the Rivers and Harbors Act of 1890, sections 15, 19, and 20 of the Rivers and Harbors Act of 1899, and an act of September 17, 1965, govern the removal of wrecks and obstruc-Government removal, absent formal abandonment, involves the taking of private property. Removal is not generally undertaken unless an obstruction influences general navigation. Procedures are detailed for: (1) reporting accidents affecting navigation, (2) informing the Coast Guard, (3) requesting removal authority and funds, and (4) the marking of obstructions. Legal guidelines relating to removal authority and the establishment of owner abandonment are also provided. (Earl-Florida) W71-08238

OILY-WATER SEPARATORS AND SEWAGE DISPOSAL SYSTEMS: VESSEL REQUIRE-MENTS.

33 Code of Federal Regulations, Secs 401.102-19, 401.102-20 (1970). 1 p.

Descriptors: *Ships, *Coast Guard regulations, *Oily water, *Sewage treatment, Oil wastes, Sewage disposal, Ol, Sewerage, Water pollution control, Pollution abatement, Water pollution sources, Waste water disposal, Sanitary engineering, Installation, Administrative, Administrative agencies, Administrative decisions, Mechanical equipment, Supervisory control (Power), Legal aspects, Sea water, Separation techniques, Standards, Federal government, Waste disposal. Identifiers: Administrative regulations.

Administrative regulations governing sewage and waste oil products emanating from vessels are herein detailed. It is recommended, and effective January 1, 1970, mandatory, that vessels not equipped with ordures containers shall be equipped with approved sewage disposal systems. Vessels which cannot contain waste oil products or bilge water containing such products shall be equipped with oily water sensorators or other equipped. with oily water separators or other equipment for extracting oil wastes before discharge. (Earl-Florida) W71-08239

OPERATION OF RESERVOIR IN INTEREST OF FLOOD CONTROL. Corps of Engineers, Washington, D.C.

33 Code of Federal Regulations, Title 33, Ch 2, Sec 208.17 (1970). 1 p.

Descriptors: *Vermont, *Flood control, *Reservoir operations, *Water levels, Dams, Reservoirs, Regulation, Projects, Hydroelectric power, Streams, Rivers, Streamflow, Spillways, Engineering structures, Flow control, Conduits.

In the interest of flood control, the State of Vermont shall operate the Waterbury Dam and Reservoir pursuant to this federal regulation. Above a specified level, storage space in the reservoir shall be reserved for temporary detention of flood waters. The three tainter gates shall be suspended in their open position except when being utilized for flood control. The regulation describes the cir-cumstances under which the tainter gates shall be closed. The State of Vermont shall furnish the Disrict Engineer of the Corps of Engineers a monthly report showing: (1) the daily elevation of the reservoir pool, (2) daily reservoir inflow, and (3) daily releases over the uncontrolled spillway through the tainter gates and through the bypass conduit. Whenever the reservoir exceeds a specified level the state shall keep the District Engineer currently informed of reservoir data. These regulations are subject to modification in time of emergency. (Duss-Florida)
W71-08240

FEDERAL ASSISTANCE FOR RESOURCE CONSERVATION DEVELOPMENT PROJECTS. House Report No 1247, 91st Cong, 2d Sess, 8 US Code Cong and Admin News, p 2825-2828 (1970).

Descriptors: *Resource development, *Water resources development, *Projects, *Conservation, Multiple-purpose projects, Federal project policy, Wildlife, Wildlife conservation, Fish, Fish conservation, Recreation, Recreation facilities, Project Planning Federal government Administration planning, Federal government, Administrative agencies, Administration, Cost sharing, Government finance, Land, Easements, Right-of-way, Contracts, Legislation. Identifiers: *Bankhead-Jones Farm Tenant Act.

Recommending passage of an amendment to the Bankhead-Jones Farm Tenant Act to authorize the Secretary of Agriculture to furnish financial assistance for resource conservation and development projects, this House Report considers the purpose, background, need for, and other aspects of the bill. The measure would authorize the Secretary to bear an equitable portion of the costs of water-based fish and wildlife or recreational projects developed under the Bankhead-Jones Act. Cost-sharing would be limited to water-based projects, and provisions delineate which projects can qualify for assistance. Resource conservation and development programs with federal planning assistance have existed since 1963, and such programs are designed to strengthen the rural economy. There is need for the present bill because development of resources for outdoor recreation purposes has great potential for economic growth. Such resources are in short supply throughout the nation. The bill would aid in the development of multiple-purpose projects. A letter from the De-

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partment of Agriculture is included and recommends passage of the bill. (Duss-Florida) W71-08241

STANDARDS FOR PROTECTION AGAINST RADIATION.

Atomic Energy Commission, Washington, D.C.

10 Code of Federal Regulations, Secs 20.1, 20.2, 20.301 thru 20.305 (1970). 4 p.

Descriptors: *Radioactive waste disposal, *Radioactive wastes, *Sewage disposal, *Nuclear wastes, Environmental sanitation, Waste disposal, Sewerage, Water pollution sources, Radiation, Radioactivity, Nuclear energy, Environmental effects, Soil environment, Soil management, Soil disposal fields, Groundwater, Surface waters, Incineration, Administration, Administrative decisions, Administrative agencies, Adoption of practices, Water pollution control. Identifiers: *Atomic Energy Act of 1954.

Issued pursuant to the Atomic Energy Act of 1954, these administrative regulations establish radiation protection standards for AEC licensed activities. No licensee shall dispose of material except by transfer to an authorized recipient or as provided herein. Disposal application for licensed waste material should include a description of the material should include a description of the material. al and pertinent environmental information. This at and pertinent environmental information. This includes: (1) topographical, geological, and meteorological characteristics; (2) ground and surface water usage; (3) other potentially affected facilities; and (4) procedures to minimize risk. Applications will not be accepted to dispose of author's materials on private lands. No licensee shall discharge materials into a sanitary sewerage system unless: (1) the material is readily soluble or dispersible and both the gross quantity disposed and the concentration level, when diluted by the average daily sewage release, do not exceed standards herein set forth. Material shall not be disposed of by burial in soil unless: (1) the quantity buried does not exceed standards set forth herein, (2) burial is at a minimum of four feet, and (3) there are no more than twelve successive burials separated by at least six feet. Without specific approval, material shall not be treated or disposed of by incineration. (Earl-Florida) W71-08242

SOIL AND WATER MANAGEMENT ON MILITARY INSTALLATIONS. Department of Defense, Washington, D.C.

32 Code of Federal Regulations, Part 234 (1970).

Descriptors: *Water management (Applied), *Soil management, *Military aspects, *Water utilization, Regulation, Administrative agencies, Administration, Projects, Project planning, Conservation, Natural resources, Water pollution, Pollution abatement, Water supply, Domestic water, Irriga-tion, Irrigation systems, Irrigation, Operations and maintenance, Land use, Runoff.

procedures for implementing a balanced and integrated program for soil and water management and related natural resources as required by the Department of Defense (DOD), these administrative regulations apply to all DOD members. For purposes of the regulations, various types of grounds on military installations are defined. The objective of the regulations is to conserve, develop, maintain and manage lands in an efficient manner and, among other things, to cooperate in pollution abatement and waste disposal. Soil and water conservation plans shall be developed by professionally competent personnel and be applied continuously at all installations having significant land management problems or responsibility. Special problems of conservation and development of natural resources shall be identified and included as part of the plans. As relates to water management, irrigation shall be

limited to areas where supplemental water is essential to establish improved types of vegetation. Irrigation systems shall utilize the minimum amount rigation systems shall utilize the minimum amount of water necessary to support vegetation and not interfere with military and domestic water supply requirements. The regulations prescribe procedures for project proposals, construction and program evaluation. (Duss-Florida) W71-08243

KEY LARGO CORAL REEF PRESERVE.
Department of the Interior, Washington, D.C.

Code of Federal Regulations, Title 43, Subtitle A, part 15 (1970). 3 p.

Descriptors: *Reefs, *Supervisory control (Power), *Preservation, *Florida, Federal jurisdiction, Boating regulations, Water pollution control, State governments, Fishing, Dredging, Coordination, Federal government, Marine geology, Shoals, Regulation, Adoption of practices, Integrated control measures, Non-structural alternatives, Administrative agencies, Administrative practices, Administration, Legal aspects, Legislation, Wildlife conservation, Natural resources.

The Department of the Interior herein sets forth regulations governing the operation of the key Largo Coral Reef Preserve. It is the policy of the Department to cooperate with the State of Florida in preserving the reef. The removal or destruction of natural reef features or marine life is forbidden. No dredging excavating, or filling operations are permitted in the Preserve. The dumping or deposit-ing of refuse or polluting substances is prohibited. No person shall willfully destroy, molest, or tamper with any wrecks or cargoes thereof within the Preserve. The removal or defacing of Preserve signs and monuments is forbidden. Spear fishing or signs and monuments is forbidden. Spear fishing or the use of poisons, electric charges, or other such fishing methods is prohibited. Skin diving for obser-vation or pleasure is encouraged. The collection of scientific specimens shall be allowed only under written permit. No watercraft shall be operated so as to strike or damage natural features. The use or possession of explosives or dangerous weapons within the Preserve is forbidden. The Preserve may be closed to the public in the event of emergencies. Accidents shall be promptly reported. All federal acts and Florida laws and regulations shall be enforced. (Earl-Florida) W71-08244

MANAGEMENT OF LANDS AFFECTED BY THE WILD AND SCENIC RIVERS ACT. 43 Code of Federal Regulations, Secs 6223.0-1

thru 6223.0-6 (1970). 2 p.

Descriptors: *Rivers, *Environment, *Conservation, *Administration, Legislation, Regulation, Wildlife, Recreation, Fish, Federal government, Benefits, Natural streams, Administrative agencies. Identifiers: *Wild and Scenic Rivers Act.

Promulgated pursuant to the Wild and Scenic Rivers Act, these regulations seek to foster the aims of that Act. The Wild and Scenic Rivers Act provides that certain selected rivers shall be preserved in their free-flowing condition and their immediate environments protected for the benefit and enjoyment of present and future generations. The purpose of these regulations is to provide guidelines for management of lands affected by the Act and to assure that lands are managed in a manner consistent with the purposes of the Act. The policy is to identify lands affected by the Act as soon as possible. (Duss-Florida) W71-08245

OPEN BEACHES ACT OF 1971 (A BILL DECLARING A PUBLIC INTEREST IN THE OPEN BEACHES OF THE NATION).

Senate Bill 631, 92nd Cong, 1st Sess (1971). 9 p.

Descriptors: *Beaches, *Public rights, *Public benefits, *Condemnation, Recreation, Public lands, Legal aspects, Land tenure, National seashores, Federal government, State governments, Federal jurisdiction, State jurisdiction, Compensation, Condemnation value, Easements, Eminent domain Legislation. domain, Legislation.

Under this proposed legislation the public shall have a free and unrestricted right to use the beaches of the United States to the full extent that such public right may be extended consistent with the constitutional property rights of littoral landowners. No person shall construct or maintain an obstruction which interferes with the right of the public to enter, lease, cross or use the public beaches. The United States district courts may adbeaches. The United States district courts may adjudicate actions: (1) to establish and protect the public right to the beaches, (2) to determine the existing status of title, and (3) to condemn such easements as are necessary to accomplish the purposes of this bill. Certain evidentiary rules are set out by this bill. This bill does not interfere with the authority of the states to act for the public benefit. Interests in land recovered under authority of this bill shall be subject to state ownership, and the states must provide at least 25% of the cost of condemnation. The federal government and the states shall act in joint partnership to accomplish the purposes of this bill. Definitions of relevant terms are provided. (Robinson-Florida) W71-08246

NATIONAL MARINE WATERS POLLUTION CONTROL AND QUALITY ENHANCEMENT ACT OF 1971 (A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL

Senate Bill 1011, 92d Cong, 1st Sess (1971). 10 p.

Descriptors: *Waste dumps, *Coasts, *Waste Descriptors: *Waste dumps, *Coasts, *Waste disposal, *Water pollution control, Pollution abatement, Sewage disposal, Ultimate disposal, Oceans, Continental Shelf, Sea water, Shores, Waste treatment, Coastal structures, Offshore platforms, Ships, Water pollution sources, Water pollution, Treatment facilities, Standards, Regulation, Administrative securics, Endead coverant, States ministrative agencies, Federal government, State governments, Legislation, Legal aspects. Identifiers: *Contiguous zone.

Entitled the National Marine Waters Pollution Control and Quality Enhancement Act of 1971, this proposed amendment to the Water Pollution Control Act would provide means and measures to control the discharge of wastes into the waters of the contiguous zone and the sea. No persons could discharge wastes into the waters of the contiguous zone from any vessel, except sewage discharged from marine sanitation devices, or from any onshore or offshore facility. No wastes could be discharged into waters beyond the contiguous zone unless permitted by the Environmental Protection Agency pursuant to regulations promulgated in this Act. Civil penalties for violations are provided, along with procedures for enforcement. The Environmental Protection Agency would be given authority to issue regulations governing the discharge of wastes in waters beyond the contiguous zone by establishing quantities, times, locations, circumstances, and conditions of such discharges. Limitations on the regulations are set forth, along with provisions for research and grants for the construction of treatment works. (Smiljanich-Florida) W71-08247

BUREAU OF LAND MANAGEMENT PROGRAM POLICY--ENVIRONMENTAL CONSIDERATIONS.

Bureau of Land Management, Washington, D.C.

Federal Register, Vol 36, No 65, Saturday, Apr 3, 1971, p 6422-6423.

Descriptors: *Land management, *Environmental effects, *Public lands, *Adoption of practices,

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Land resources, Water resources, Natural resources, Land development, Conservation, Land use, Water management (Applied), Water resources development, Project purposes, Longterm planning, Federal government, Administrative agencies, Legislation, Administration, Coordination, Regulation, Industrial production, Social needs, Ecology, Legal aspects, Programs.

Pursuant to the National Environmental Policy Act and an executive order, the Secretary of the Interior herein amends regulations relating to the Bureau of Land Management. Interested parties submitted suggestions which are incorporated into the revised regulations. Environmental considerations in land management shall include: (1) the attainment of the widest range of beneficial uses of the environment without undue environment degradation or ment without undue environment degradation or risk to health or safety; (2) the attainment of optimum production of land products consistent with acceptable environmental quality; and (3) the preservation of historic, cultural and natural aspects of the national heritage. Matters to be considered are: (1) existing or future economic and social needs; (2) effect on other resource values; (3) inter-agency coordination and cooperation; (4) consistency with national programs; (5) compatibility of possible uses; and (6) compatibility with objecterm productivity and environmental integrilong-term productivity and environmental integrity. (Smiljanich-Florida) W71-08248

THE ROLE OF THE COURT IN PROTECTING THE ENVIRONMENT--A JURISPRUDENTIAL ANALYSIS.

Manton M. Grier. South Carolina Law Review, Vol 23, No 1, p 93-113, 1971. 21 p, 80 ref.

Descriptors: *Resource allocation, *Decision makbescriptors: "Resource allocation, "Decision making, "Judicial decisions, "Institutions, Adjudication procedure, Pollution abatement, Environment, Water allocation (Policy), Resource development, Water resources development, Institutional conwater resources development, institutional constraints, Governments, Legislation, Water pollution, Water pollution control, Water quality, Water distribution (Applied), Political aspects, Social aspects, Social values, Water policy, Legal aspects.

Protection for the environment is increasingly being sought through the courts. An examination is made in this article of the proper role that a court as an institution should play in protecting the environment. When courts are asked to solve environmental problems, questions arise as to whether they are institutionally suited to solve the problems and whether the courts have the constitutional power to consider the problem. The end result of adjudication is the formal declaration of rights and wrongs. Adjudication is therefore not a proper form of deciding how the community should allocate its scarce resources. Questions involving such discretion should be left to the legislature. The polycentric features of resource allocation, wherein there are many interacting centers of influence, also suggest that courts should play a more limited role in trying to solve the environmental crisis. The constitutional aspects of the institutional limits of adjudication are 'standing' and 'political questions'. The court's role as an institution should be to enforce the basic requirements of social living by enjoining forms and levels of pollution that constitute a threat to the continued existence of society. (Smiljanich-Florida) W71-08249

ENVIRONMENTAL LAW--NUISANCE--IN-JUNCTIVE RELIEF DENIED IN PRIVATE AC-TION FOR NUISANCE CAUSED BY INDUSTRI-AL POLLUTER.

New York University Law Review, Vol 45, p 919-927, 1970. 45 ref.

Descriptors: *Air pollution, *Pollution abatement, *Remedies, *New York, Legal aspects, Judicial decisions, Environment, Environmental effects, Legislation, Pollutants, Air pollution effects, Damages, Public health, Water pollution, Water pollution control. identifiers: *Injunctions.

Considering the availability of injunctive relief in New York in private actions for pollution abatement, this article discusses the decision in Boomer v. Atlantic Cement Co, 26 N.Y. 2d 219, 257 N.E.2d 870, 309 N.Y.S.2d 312 (1970). In Boomer plaintiffs sought to restrain defendant cement plant from emitting dust and raw materials and conducting blasting operations to the detriment of plaintiff's property. In the ultimate decision the Court of Appeals of New York granted plaintiffs a tempora-Appears of New York granted plaintiffs a temporary injunction, to be vacated upon the payment of permanent damages by defendant. The majority found this to be the most equitable and practicable remedy, compensating plaintiffs and avoiding closing defendant's plant. The effect of the decision was to apply a new balancing test in New York; an injunction should not be granted when the horn to injunction should not be granted when the harm to the defendant in granting it is greater than to the plaintiff in denying it. The central argument of the majority is that private actions are not the most practical method for effective control of polluters, that is, questions of pollution control should be decided by the legislature and not by private lawsuits. This article disagrees with the Boomer decision. The decision unnecessarily inhibits the rights of individuals, appears to contravene the actual intent of the legislature, and does not provide adequate incentive for defendants to abate pollution. (Duss-Florida) W71-08250

ENVIRONMENTAL REPORTS FOR NUCLEAR POWERPLANTS. Atomic Energy Commission, Washington, D.C.

Federal Register, Vol 36, No 52, Wednesday, Mar 17, 1971, p 5150.

Descriptors: *Nuclear powerplants, *Environmental effects, *Permits, *Regulation, Federal government, Operations, Administration, Administrative agencies, Construction.

Identifiers: *National Environmental Policy Act of

Under the Atomic Energy Commission's regulations for implementing the National Environmental Policy Act of 1969, applicants for nuclear powerplants and licenses are required to submit an environmental report at the time they file an application for a construction permit. They are required to update this report, to the extent that environmental consideration differ significantly from those in the earlier report, at the time they file for an operating license. The Atomic Energy Commission has prepared a draft guide for such reports. Comments and suggestions for improvements in this draft are encouraged. (Duss-Florida) W71-08251

ENVIRONMENTAL QUALITY. Department of Agriculture, Washington, D.C.

Federal Register, Vol 36, No 52, Mar 17, 1971, p

Descriptors: *Administrative agencies, *Administration, *Environment, *Environmental effects, Legislation, Federal government.
Identifiers: *National Environmental Quality Act.

Since the Department of Agriculture has many concerns and responsibilities regarding environmental quality, the Secretary has enunciated a general environmental policy for the Department in a Secretary's memorandum. The memorandum pays particular attention to the National Environmental Policy Act of 1969, related executive orders, and other guidelines and directives from the Office of the President. (Duss-Florida) W71-08252

OIL POLLUTION FROM SHIPS,

116 Cong Rec H 4571 (daily ed), 6 US Code Cong and Admin News, p 1947-1950 (1970). 4 p.

Descriptors: *Water pollution sources, *Ships, *Oil, *Pollution abatement, Oil wastes, Oily water, Federal government, Pollutants, International waters, Harbors, Water pollution effects, Treaties, Legislation, Oil industry, Port authorities, Wastes, Naval architecture, Navigation, Coast Guard regulations, International law, Standards, Water quality, Radio communication systems, Permits, Legal aspects.

aspects.
Identifiers: *Presidential messages, Oil spills.

The President of the United States herein submits The President of the United States herein submits to Congress a special message with his proposals for curbing oil pollution from ships. The increase in seaborne oil transport has resulted in increased oil pollution hazards through ships collisions or waste discharges. This message outlines actions Congress should take to reduce the risks of oil pollution. Among such proposals are: (1) the ratification of certain international conventions dealing with oil pollution of sea waters: (2) enactment of the Ports pollution of sea waters; (2) enactment of the Ports and Waterways Safety Act giving the Coast Guard additional authority to protect against oil spills; (3) requirement of direct radio communications between vessels; (4) the licensing of towboat operators of uninspected vessels; and (5) the financing of oil-spill cleanup operations through the use of a revolving fund with reimbursement by the use of a revolving fund with reimbursement by those responsible. In addition, executive measures to be taken include: (1) a search for effective multilaterial action to prescribe international standards for the construction and operation of tankers; (2) increased surveillance along shorelines to detect oil spills; (3) the establishment of Harbor Advisory Radar Systems; and (4) research and development of emergency oil transfer and storage systems. (Smiljanich-Florida)
W71-08253

HUDSON RIVERWAY--LICENSE APPLICA-

Senate Report No 771, 91st Cong, 2d Sess, 5 US Code Cong and Admin News, p 1433-1435 (1970).

Descriptors: *Hudson River, *River basin development, *Permits, *Interstate compacts, Legislation, Water resources development, Water conservation, Natural resources, Political aspects, Water policy, Water resources, River basins, Rivers, National historic sites, Environmental effects, Coordination, Administrative agencies, Negotiations, Recreation, Project planning, Federal government, State governments, Legal aspects.

The Senate Interior and Insular Affairs Committee herein recommends passage of an amendment to existing legislation. The existing act provides for regulation of water resources of the Hudson Riverway. It grants congressional consent to an interestate compact relating to the preservation and development of the natural, historic, and recreational resources of the Hudson River Basin. In order to protect the resources of the river basin while compact negotiations were being held, the act provides for consultation between the Secretary of the Interior and any agencies contemplating activity within or affecting the Riverway. The act further sets forth license requirements activities which might affect the resources of the Hudson Riverway. The amendments herein under con-sideration would extend the deadlines contained in the existing act. The Committee notes that although the National Environmental Policy Act of 1969 imposes more rigorous requirements on ap-1969 Imposes more rigorous requirements on approval of proposed activities having environmental impact, the amendments under consideration would provide interim protection while the procedures of that act are still being established. The Committee report includes a letter from the Department of the Interior expressing approval of the proposed amendment. (Smiljanich-Florida) W71-08254

Nonstructural Alternatives—Group 6F

HUGHES V. WASHINGTON: SOME FEDERAL COMMON LAW IN THE REAL PROPERTY

Robert E. Beck. North Dakota Law Review, Vol 47, No 1, p 77-98, 1970. 104 ref.

Descriptors: *Accretion (Legal aspects), *Boundary disputes, *Federal jurisdiction, *State jurisdiction, Land tenure, Property (Boundaries), Washington, Riparian land, Riparian rights, Beds, Ownership of beds, Oceans, Navigable waters, Non-navigable waters, Water law, Federal government, Bedier of waters, Legal aspects budget designed. ment, Bodies of water, Legal aspects, Judicial deci-

Analyzing the decision of the United States Supreme Court in Hughes v. Washington, 389 U.S. 290 (1967), this article discusses federal common law in the real property area with specific regard to ownership of accreted land. In Hughes the Court held that federal law controlled, in Washington state, the ownership of accretion gradually deposited by the ocean on land which had been conveyed by the United States prior to Washington's statehood. It thus overruled the Supreme Court of Washington which had held, because of a constitutional provision, that the alluvion belonged to the state. According to the author there are important questions as to the basis and scope of the decision. There are two major problems in this type of case: (1) Is there a federal question; and (2) If there is a federal question, should local law apply. The author discusses prior federal cases and finds little precedent for finding a federal question or excluding local law in such cases. Because of the particular facts of Hughes, the author feels there could have been a federal question and the decision was correct. Nevertheless, the case should not apply to states in different legal situations and should apply to states in different legal situations and should apply only where there is a federal grant prior to statchood and involving tidelands. (Duss-Florida) W71-08255

ENVIRONMENTAL LITIGATION--WHERE THE ACTION IS,

Frank P. Grad, and Laurie R. Rockett Natural Resources Journal, Vol 10, No 4, p 742-762. Oct 1970. 71 ref.

Descriptors: *Judicial decisions, *Natural resources, *Legal aspects, *Environment, Environmental effects, Adjudication procedure, Non-structural alternatives, Public rights, Administration, Legislation, Eminent domain, Institutional con-straints, Planning, Aesthetics, Wildlife conserva-tion, Balance of nature, Governments, Federal government, State governments, Administrative agencies, Conservation.

Examining the type of lawsuits included in the term 'environmental litigation', this article considers whether such litigation can make a significant contribution to environmental protection. Because of procedural prerequisites, negating substantive doctrines, and judicial reluctance to enunciate broad policy in private litigation, litigation between private parties is rejected as an efficient vehicle for environmental protection. While recognizing the important rule of enforcement litigation by public agencies, the authors also reject enforcement litigation as an affirmative environmental protection device. This view is grounded upon considerations of administrative reluctance in enforcing legislation and procedural and constitutional barriers to enforcement actions. The authors consider private actions against public agencies, to compel environmental protection, as the most significant area of environmental litigation. A discussion of recent cases and the expansion of standing compares ac-tions based on the preservation of a particular resource with the less successful actions seeking to protect generalized environmental interests. Several newly defined legal theories and re-evaluations of the administrative process, stimulated by environmental litigation, are evaluated. Dangers in over-utilization of environmental litigation and its usefulness as a device for focusing public attention and inducing legislation are discussed. (Earl-Florida)

W71-08256

RIPARIAN RIGHTS.

In: Adkins, JC, Florida Real Estate Law and Procedure, Harrison Company, Atlanta, p 1611-

Descriptors: *Riparian rights, *High water mark, *Riparian land, *Florida, Navigable waters, Artificial use, State governments, Legislation, Legal aspects, Natural use, Navigation, Ownership of beds, Relative rights, Remedies, Riparian waters, Usufructuary right, Water pollution, Boating, Fishing, Land tenure, Real property, Accretion (Legal

The nature of riparian rights are considered in the first section of this article. Riparian rights are defined, and limitations upon riparian rights are set forth. The relationship between riparian rights and forth. The relationship between riparian rights and conveyances of riparian land is discussed. The second section defines the limits of riparian land ownership. Holdings of Florida courts are analyzed with respect to definitions of: (1) ordinary high tide, and (3) shore. Rules promulgated by Florida courts for determining the location of the high water mark are considered. The course lower lands to the second courts for the second courts. sidered. The common law right to erect wharves or piers for access to navigable waters, with the consent of the sovereign, is primarily considered in the third section. An invasion of the sovereign's pro-perty right or 'purpresture' is discussed. The perty right of pulpressure a landau remaining sections consider the remedy available for special injury to riparian rights and the severability of riparian rights from the land. (Hart-Florida) W71-08257

AN ACT RELATING TO THE PUBLIC AND EN-VIRONMENTAL HEALTH AMENDING THE FLORIDA AIR AND WATER POLLUTION CONTROL ACT BY PROVIDING ADDITIONAL **GROUNDS FOR INJUCTIVE RELIEF**

Florida Laws, Ch 70-139, p 486 (1970), amending Fla Stat Sec 403.131.

Descriptors: *Florida, *Water pollution control, *Pollution abatement, *Remedies, Air pollution, Administration, Administrative decisions, Adoption of practices, State governments, Administrative agencies, Environment, Environmental sanitation, Supervisory control (Power), Adjudication procedure, Legislation, Legal aspects, Environmental effects.

Identifiers: Injunction (Prohibitory), Injunction (Mandatory).

The Florida Air and Water Pollution Control Act is hereby amended to provide additional grounds for injunctive relief proceedings. Upon a finding that a generalized air or water pollution condition has created an emergency requiring immediate action to prevent harm to property or animal, plant, or aquatic life, injunctive relief shall be sought. (Earl-

W71-08258

AN ACT RELATING TO THE DEPARTMENT OF AIR AND WATER POLLUTION CONTROL: ENFORCEMENT PROCEDURE FOR TEMPORARY AND NON-CONTINUING VIOLATIONS.

Florida Laws, Ch 70-114, p 425-426 (1970) amending Fla Stat Sec 403.121.

Descriptors: *Florida, *Pollution abatement, *Remedies, *Administrative decisions, Water pollution control, Air pollution, Legislation, Legal aspects, Administration, Administrative agencies, Supervisory control (Power), Constraints, State governments, Local governments, State jurisdiction, Pollutants, Pollutant identification, Water quality control.

The alternative enforcement procedures provided the Florida Department of Air and Water Pollution Control, in this amendment to existing legislation,

shall not apply to municipalities or political subdivisions. Upon reason to believe that a temporary or non-continuing violation of this act has oc curred, the director of the Department or his delagatee may issue a citation ordering corrective action. Citable violations include, but are not limited to: (1) spills of polluting substances, (2) open burning, and (3) sudden discharges of pollutants. No administrative hearing shall be required. Citations shall state the date of the corrective action's commencement and completion. Cases in which such dates are not met may be referred to the prosecuting attorney. When warnings would best serve the public interest, the director shall not be required to report minor violations. Citations are appealable and may be suspended pending a departmental hearing. It shall be the duty of prosecuting attorneys to investigate and, when warranted, prosecute reported violations. Violations of this subsection shall be a misdemeanor. (Earl-W71-08259

NICHOLS V VILLAGE OF MORRISTOWN (LIABILITY OF CITY FOR BACKWATER FLOODS DUE TO CONSTRUCTION OF CUL-

257 NW 82-83 (Minn 1934).

Descriptors: *Minnesota, *Obstruction to flow, *Culverts, *Floods, Alteration of flow, Natural flow doctrine, Riparian rights, Streamflow, Backwater, Overflow, Rain, Streams, Riparian land, Relative rights, Ditches, Bridges, Local governments, Cities, Judicial decisions, Legal

Plaintiff landowner sued defendant seeking to enjoin the obstruction of a watercourse and to compel the city to remove a culvert and install a bridge in its place. Plaintiff also claimed damages for past inundations of his property. Plaintiff contended that in replacing a bridge across a stream with a tile culvert and ditch, defendant had interfered with the natural flow of the watercourse and had caused plaintiff's lands to flood. Defendant contended that plaintiff's lands were naturally subject to occasional floods due to a backup of water from a river into the stream tributary. In affirming a lower court judgment for defendant, the Supreme Court of Minnesota noted that plaintiff's lands had been subject to floods before the bridge was replaced by a culvert. The city had provided an adequate outlet for the flood waters. The outlet was reasonably sufficient for such rains as might be anticipated. Defendant had therefore not substantially interfered with the natural flow of the watercourse. (Smiljanich-Florida) W71-08266

WATER QUALITY STANDARDS: ENFORCE-MENT AND COMPLIANCE,

Federal Water Quality Administration, Washington, D.C.

For primary bibliographic entry see Field 05G. W71-08305

DEVELOPING AND APPLYING STANDARDS AT THE STATE LEVEL.

Pennsylvania Dept. of Health, Harrisburg. Div. of Water Quality.

For primary bibliographic entry see Field 05G.

ENVIRONMENTAL INFLUENCE ON POWER OPERATION,

American Electric Power Service Corp., New

For primary bibliographic entry see Field 05G. W71-08312

Group 6F—Nonstructural Alternatives

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, BAYOU METO AND TRIBUTARIES, JACKSONVILLE ARKANSAS.

Corps of Engineers, Vicksburg, Miss. For primary bibliographic entry see Field 04A.

FLOOD PLAIN INFORMATION, MIDDLE FORK FORKED DEEP RIVER AND TRIBUTARIES, VICINITY OF HUMBOLDT, TENNESSEE. Corps of Engineers, Memphis, Tenn.

For primary bibliographic entry sec Field 04A

6G. Ecologic Impact of Water Development

LAND AND WATER RESOURCES PLANNING ACT OF 1971 (A BILL TO AMEND THE WATER RESOURCES PLANNING ACT TO IN-CLUDE PROVISION FOR A NATIONAL LAND USE POLICY).

For primary bibliographic entry see Field 06E. W71-07723

DAM LOOSES A FLOOD OF PROBLEMS, For primary bibliographic entry see Field 04A

THE CROSS-FLORIDA BARGE CANAL: A LES-SON IN ECOLOGY,

Suzy Fisher.

Civil Engineering, Vol 41, No 4, p 44-48, Apr 1971.5 p, 2 fig.

Descriptors: *Canal construction, *Ecology, *Environmental effects, *Florida, Canals, Governments, Fish conservation, Wildlife conservation, Water pollution, Algae, Surface waters. Identifiers: *Environmental protection.

President Nixon's decision to halt construction of the Cross-Florida Barge Canal last January climaxed an extended battle between conservationists and the U.S. Army Crops of Engineers. After the Corps began construction in 1964, unfavorable reports trickled in from Interior Department agencies. The Bureau of Sport Fisheries and Wildlife said canal development would harm animals living in the region. Later, the Federal Water Pollution Control Administration predicted that dense algal blooms would develop in canal impoundments, restricting uses of these waters. Florida's Game and Fresh Water Fish Commission added that canal construction would impair sport fishing. Others charged the benefit/cost ratio set for the project was unrealistic. Conservation groups organized to fight the canal in the late Sixties. This experience indicates that in the future, large-scale development projects will go hand-in-hand with environmental safeguards, and those who neglect environmental standards will find their projects in trouble. (Woodard-USGS) W71-08105

DESERTIFICATION VERSUS POTENTIAL FOR RECOVERY IN CIRCUM-SAHARAN TERRITO-

Cairo Univ., Giza (Egypt). Dept. of Botany For primary bibliographic entry see Field 04C. W71-08136

A PROSPECT OF LAKE KARIBA,

University Coll. of Rhodesia, Salisbury For primary bibliographic entry see Field 02H W71-08141

07. RESOURCES DATA

7A. Network Design

DATA ERROR EFFECTS IN UNIT HYDRO-GRAPH DERIVATION (Discussion),

Krishan P. Singh. J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY7, p 1633-1636, Jul 1970. 1 tab, 2 ref.

Descriptors: *Unit hydrographs, *Methodology. Identifiers: *Error analysis, *Data analysis.

The author comments upon the analysis of the errors of the first three of the four methods of unit hydrograph derivation studied in the original paper: (1) Laguerre Functions Method (LFM); (2) Harmonic Series Method (HSM); (3) Least Square Method (LSM); and (4) Gamma Distribution Method (GDM); when the basic data (the hyetograph and hydrograph) were in error. The mean errors, as a percentage, for the four methods of derivation using error-free data are presented in a table. Errors due to functional structure and flexibility of the methods are demonstrated. Further investigation is suggested concerning the fact that the derived unit hydrographs will differ more from the true ones for smaller durations of rainfall excess and errors in data. (See also W70-02454) W71-07842

COMPUTER DETERMINATION OF THE GEOMETRY AND TOPOLOGY OF STREAM NETWORKS.

Purdue Univ., Lafavette, Ind. Dept. Geosciences; and Toronto Univ. (Ontario). Dept. of Civil Engineering.
D. M. Coffman, and A. K. Turner.

Water Resources Research, Vol 7, No 2, p 419-423, Apr 1971. 5 p, 2 fig, 2 tab, 7 ref. OWRR Project A-007-IND (1).

*Drainage patterns (Geologic), *Geomorphology, *Topography, *Terrain analysis, Watersheds (Basins), Networks, Mathematical studies, Drainage systems, Channel morphology, Identifiers: *Topology, *Stream networks.

Binary string descriptions of stream networks provide only topologic information. Applied geomorphic and engineering studies of drainage basins require network geometry as well as topology. An extension of binary string methods of data collection permits both stream classification and computation of geometric parameters. Two years' experience demonstrates the ability of this single data collection operation to provide all the information necessary for a complete analysis of real stream networks. (Knapp-USGS) W71-07911

A PROPOSED STREAMFLOW DATA PROGRAM FOR SOUTH CAROLINA,

Geological Survey, Columbia, S. C. Jeffrey T. Armbruster.

Geological Survey Open-file Report, 1970, 30 p, 1

fig, 2 plate, 8 tab, 8 ref.

Descriptors: *Streamflow, *Network design, *Data collections, *South Carolina, Planning, Stream gages, Hydrologic data, Regression analysis, Gaging stations, Natural flow, Regulated flow, Peak discharge.

Identifiers: Streamflow characteristics, Data evaluation.

An evaluation of the available streamflow data in South Carolina was made to provide guidelines for planning future surface-water data programs. The basic elements in the evaluation procedure were (1) establishment of objectives and goals of the program, (2) examination and analysis of all available data to determine which goals have already

been met. (3) consideration of alternate methods of meeting the remaining goals, and (4) identifica-tion of elements that should be included in the future program. Four categories of data that form the framework of program design are current-purpose data, planning and design data, data to define longterm trends, and stream environment data. An acterm trends, and stream environment data. An accuracy goal for planning and design data of an equivalent of 10 years of record was specified for minor streams. Many of the goals can be met by generalizing data for gaged basins by regression analysis. Appropriate changes could be made in the present data program based on this fact. A Streamflow data program based on the guidelines developed in this study is proposed. (Woodard-USGS) USGS) W71-07970

USU TELEMETERING PRECIPITATION GAGE

NETWORK, Utah State Univ., Logan. Coll. of Engineering For primary bibliographic entry see Field 02B. W71-08131

TELEMETRY SYSTEM MODIFICATIONS AND

1968-69 OPERATION, Utah State Univ., Logan. Coll. of Engineering. For primary bibliographic entry see Field 02B. W71-08132

RANDOM-WALK MODEL OF STREAM NET-WORK DEVELOPMENT,

IBM Watson Research Center, Yorktown Heights,

N.Y. J.S. Dmart, and V. L. Moruzyi. Available from the National Technical Information Service as AD-717 370, \$3.00 in paper copy, \$0.95 in microfiche. ONR Contract No N00014-70-C-0188, Task No NR 389-155, Technical Report No 2, Oct 1970, 21 p, 5 fig, 4 tab, 16 ref.

Descriptors: *Mathematical models, *Computer programs, *Streams, *Network design, Growth rates, Runoff, Simulation analysis. Identifiers: *Random-walk model.

A random-walk, headward-growth model of stream network development in a region of uniform lithology and uniform slope was proposed. The principal difference from previous models was that the probability of growth was made dependent on the area contributing runoff to the stream tip. In this model, a decision about whether a given stream segment should be allowed to grow was reached by examining the area immediately upslope. To obtain some feeling for the range and applicability of this model, two particular versions, A and B, were promodel, two particular versions, A and B, were programmed and tested. The major difference between the two versions was that Version A would allow no growth at all at active site A while Version B would allow growth to the right only. Each version was run 25 times for each of six different values of vertical dimension (w) and where the horizontal dimension (L) was set at a constant. The two versions were selected for simplicity with the results quantitatively satisfactory and where less input data and fewer arbitrary rubs were required. A major advantage was that all the important network variables, including drainage density and outlet density, came naturally out of the simulation processes. (Kriss-Cornell) W71-08190

7B. Data Acquisition

HONEYCOMB THERMAL TRAP.

New Mexico State Univ., University Park.
P. Pellette, M. Cobble, and P. Smith.
Journal of Solar Energy, Vol 12, No 2, p 263-265, 1968. 5 fig. 4 ref. OWRR Project A-015-NMEX

Descriptors: *Heat transfer, Water utilization, *Temperature, *Solar radiation, Radiation, Thermal radiation, Thermal conductivity.

Data Acquisition—Group 7B

An evacuated cylindrical chamber, herein called a An evacuated cylindrical chamber, herein called a honeycomb thermal trap, was developed and tested, for the purpose of achieving moderately high temperatures without using concentrating methods. The device, which uses a hexagonal honeycomb core to diminish re-radiation losses, achieved temperatures on the order of 400 deg F on a target plate located in the interior of the cylinder. W71-07706

FLOW CHARACTERISTICS IN FLOOD-CONTROL TUNNEL 10, FORT RANDALL DAM, MISSOURI RIVER, SOUTH DAKOTA. HYDRAULIC PROTOTYPE TESTS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07802

SHADING INVERTED PYRANOMETERS AND MEASUREMENTS OF RADIA REFLECTED FROM AN ALFALFA CROP, RADIATION

Nebraska Univ., Lincoln. K. W. Brown, Norman J. Rosenberg, and P. C.

Doraiswamy.

OWRR Project No A-019-NEB (1). Water Resources Research, Vol 6, No 6, p 1782-1786, Dec 1970. 4 fig, 17 ref.

Descriptors: *Alfalfa, *Solar radiation, *Anisotropy, *Albedo, On-site data collections, Calibrations, Equipment, Instrumentation, Testing, Measurement. Identifiers: *Pyranometers, *Short-wave radiation

(Reflected).

Pyanometers are used to measure the shortwave radiation reflected by natural surfaces, including agricultural fields. Measurement problems may lead to associated data errors. Cylindrical shades may be necessary to restrict the view of inverted pyranometers if shortwave radiation is anistropically reflected. cally reflected. Since measurements must often be made over small plots, the instrument view angles must also be restricted. Measurement experiments were performed in a uniform 2 ha, alfalfa field during the summer. It was found that: (1) Measuring reflected radiation, and Eppley pyranometer requires shading above the plane of the sensor; (2) An alfalfa crop reflects shortwave solar radiation anisotropically, and shades that restrict the view angle of an inverted pyranometer to less than 160 degrees result in underestimates of solar radiation while unshaded instruments result in overestimates. (Casey-Arizona) W71-07812

REDEFINITION OF SALINITY, Scientific Committee on Oceanic Research; and In-ternational Council for the Exploration of the Sea. Hydrography Committee; and International Association of the Physical Sciences of the Ocean. For primary bibliographic entry see Field 02L. W71-07874

SPECTROPHOMETRIC DETERMINATION OF SMALL QUANTITIES OF PHENOLS, (IN RUS-SIAN),

Moscow State Univ. (USSR). For primary bibliographic entry see Field 05A. W71-07876

CONTRIBUTION TO THE THEORY OF TRICK-LING FILTER PERFORMANCE,

Denver Univ., Colo. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 05D. W71-07877

INSTRUMENTATION FOR MEAPHYSICAL PROPERTIES OF A LAKE, MEASURING

Cornell Aeronautical Lab., Inc., Buffalo, N.Y For primary bibliographic entry see Field 02H. W71-07882

ACTIVATION ANALYSIS BY CHARGED PAR-

TICLES (IN SLOVAK),
Slovak Technical Univ., Bratislava (Czechoslovakia); and Magyar Tudomanyos
Akademia Kozponti Fizikai Kutoto Intezete, Bu-

Juraj Tolgycssy, Andras Salamon, and Elek Szabo. Chemicke Listy, Vol 64, No 11, p 1121-1146, 1970. 6 fig, 7 tab, 189 ref.

Descriptors: *Nuetron activation analysis, *Analysis, Nuclear physics, Analytical techniques, Deuterium, Tritium, Ions, Helium.

Identifiers: Cyclotron, Nuclear accelerators, Neutron generators, Protons, Alpha-particles.

Advantages and shortcomings of activation analyses employing charged particles are reviewed. Particular attention is given to determination of elements using hombardment by accelerated particles, including protons, deuterons, alpha-particles, ions of tritium, and light helium. Stress is placed on the optimum conditions for performance of nuclear determinations and also the suitability of samples for this method of analysis. The review is supplemented by examples of practical application of activation analyses. (Wilde-Wisconsin) W71-07886

ON OPTIMUM CONDITIONS FOR UL-TRASONIC SEPARATION OF DIATOMS OF SANDY BENTHOS (IN FRENCH),

Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.

Michel Colocoloff, and Chantal Colocoloff. Comptes Rendus Academie des Science, Paris, Serie D, Vol 271, No 20, p 1794-1797, 1970. 1 tab,

Descriptors: *Analytical techniques, *Benthos, *Ultrasonics, Measurement, Sands, Diatoms, Density, Sediments, Frequency, Sound waves. Identifiers: Monasteriou Bay (France).

Identical samples of sandy benthos inhabited by diatoms were dispersed ultrasonically using three transmitters varying in power from 100 to 500 w and in frequency from 20 to 30 kHz. Different combinations of frequency, power, and duration of the treatment produced dispersion of an enormous range from about 22,000 to more than 1,000,000 cells per cu cm of sand. In part, this variation is due to erosion of the samples, considerably greater at low than at high frequencies. The results could also be influenced by the shape of containers, nature and volume of solution, and other conditions. Standardization of the method must be confined to benthos samples of specific granulometric and mineralogical composition. (Wilde-Wisconsin) W71-07892

MICROWAVE EVAPOTRON,

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab. R. E. McGavin, P. B. Uhlenhopp, and B. R. Bean. Water Resources Research, Vol 7, No 2, p 424-428, Apr 1971, 5 p, 6 fig, 8 ref.

*Evaporation, *Instrumentation, *Meteorology, *Meteorological data, *Data collections, Weather data, Radar, Water vapor, Mass transfer, Convection, Advection, Temperature. Identifiers: *Microwave evaporime evaporimeter. *Evaporimeters.

A microwave evapotron is described in which a modified microwave refractometer and a vertical sonic anemometer are combined to measure the vertical transport of water vapor directly by the eddy correlation method. The instrument was used successfully in the field. Ten-minute samples from this instrument compare favorably with the results from conventional methods. In terms of evapora-tion, the accuracy is within 0.02 cm/day, and the resolution is within 0.002 cm/day. (Knapp-USGS) W71-07915

AN AUTOMATIC OUTFLOW MEASURING

Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Riverina

M. L. Sharma, and R. A. Bawden.

Water Resources Research, Vol 7, No 2, p 429-431, Apr 1971. 3 p, 3 fig, 4 ref.

Descriptors: *Flow measurement, *Flowmeters, *Discharge (Water), Instrumentation, Lysimeters, Data collections, Flow rates, Gages Identifiers: Flowmeter (Automatic)

A device for continuous and accurate measurement of very small quantities and slow rates of water flow is described. Drops of uniform size are formed and counted instantaneously by digital counters as they fall between pairs of electrodes. The counts and time are recorded by automatically photographing the counters and a clock at suitable time intervals. (Knapp-USGS) W71-07917

STEAM FILM SAMPLING OF WATER FOR MASS SPECTROMETRIC ANALYSIS OF THE

DEUTERIUM CONTENT, Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.; and Atomic Energy of Canada Ltd., Chalk River (Ontario). General Chemistry Branch.

For primary bibliographic entry see Field 02K.

SEISMIC INVESTIGATION OF ICE PROPER-TIES AND BEDROCK TOPOGRAPHY AT THE CONFLUENCE OF THE NORTH AND CEN-TRAL ARMS OF THE KASKAWULSH GLACI-

Ohio State Univ., Columbus, Inst. of Polar Studies. For primary bibliographic entry see Field 02C. W71-07955

OPTICAL MEASUREMENTS ON SNOW,

Army Cold Regions Research and Engineering Lab., Hanover, N.H.

For primary bibliographic entry see Field 02C.

REMOTE SENSING OF LUMINESCENT MATERIALS.

Geological Survey, Washington, D.C.; and Perkin-Elmer Corp., Norwalk, Conn.

William R. Hemphill, George E. Stoertz, and David A. Markle.

Proceedings 6th International Symposium on Remote Sensing of Environment, Michigan University, Ann Arbor, October 13-16, 1969, Vol 1, p 565-585, 1970. 21 p, 21 fig, 30 ref.

Descriptors: *Fluorescence, *Remote sensing, *Tracking techniques, Tracers, Fluorometry, Dye releases, Path of pollutants, Oily water, Air pollution, Pollutant identification, Spectroscopy. Identifiers: Fraunhofer-line discriminator

A prototype Fraunhofer-line discriminator, suitable for aircraft operation, was built and tested using Rhodamine WT, a luminescent dye used as a tracer in studies of current dynamics in rivers and estuaries. Results of tank, shipboard, and helicopter tests show that the instrument responds to dye concentrations as small as 1 ppb, and suggest that a Fraunhofer-line discriminator should be operationally useful in time-of-travel and dispersion studies. Design modifications permit use of the Fraunhoferline discriminator in detecting natural luminescence of oil seeps and spills, some water and atmospheric pollutants, and other materials. (Knapp-USGS) W71-07961

Field 07—RESOURCES DATA

Group 7B-Data Acquisition

HYDROLOGIC COMMUNICATIONS EXPERI-MENT ON THE APPLICATIONS TECHNOLO-GY SATELLITE (ATS-1),
Environmental Science Services Administration,

Silver Spring, Md.

Allen F. Flanders, Francis V. Kohl, and Thomas W. Davis.

Proceedings 6th International Symposium on Remote Sensing of Environment, Michigan University, Ann Arbor, Oct 13-16, 1969, Vol 1, p 197-204, 1970. 8 p, 2 fig, 2 tab, 1 ref.

Descriptors: *Telemetry, *Data transmission, *Satellites (Artificial), Hydrologic data, Data collections, Monitoring, Streamflow forecasting, Data storage and retrieval. Identifiers: Hydrologic data transmission.

In a combined ESSA/NASA experiment, hydrologic data relay and equipment configuration testing was conducted via the VHF transponder on board the geostationary NASA Applications and Technology Satellite (ATS-1). Digital river and rainfall data were transmitted from hydrologic platforms in Arkansas, California, and Oregon upon satellite relayed interrogation by the NASA Command and Data Acquisition (CDA) station at Mojave, California. The data messages, relayed through the satellite, were recorded at Mojave, and transmitted to the Weather Bureau's Office of Hydrology in Silver Spring, Md., for teleprinter readout. Costs for a system of national scope appear commensurate with conventional ground systems when incorporated as part of a satellite vehicle performing other functions. The communications equipment required for the hydrologic ground sensors is estimated to be about \$5,000 per site. (Knapp-USGS) W71-07962

APPLICATION OF COMPUTER PROCESSED MULTISPECTRAL DATA TO THE DISCRIMINATION OF LAND COLLAPSE (SINK-HOLE) PRONE AREAS IN FLORIDA,

Geological Survey, Tampa, Fla.; and Michigan-Univ., Ann Arbor. Infrared and Optics Lab. A. E. Coker, R. Marshall, and N. S. Thomson.

Proceedings 6th International Symposium on Remote Sensing of Environment, Michigan University, Ann Arbor, Oct 13-16, 1969, Vol 1, p 65-77, 1970. 13 p, 6 fig, 1 tab, 9 ref. NASA Contract No R-146-09-020-011.

Descriptors: *Land subsidence, *Remote sensing, *Aerial photography, *Sinks, *Florida, Infrared radiation, Vegetation effects, Hydrogeology, Topography, Temperature, Water levels, Water level fluctuations, Subsidence, Withdrawal, Karst. Identifiers: *Sinkhole collapse.

Near Bartow, Florida, data were collected for the purpose of studying land collapse phenomena using remote sensing techniques. The multispectral scanner system recorded 18 spectral bands ranging from 0.4 to 14.0 microns, and several types of photography were used. Because areas prone to active sink collapse often are not detectable from apparent surface expression prior to actual collapse, it was necessary to apply indirect methods to the problem of detecting the surface effects caused by water pressure decline in the areas of active sinkhole development. An experiment was conducted to collect and process data for the purpose of testing the hypothesis that areas of active sinks could be detected at the land surface from the integrated effects of water loss at depth on vegetation physiology and terrain temperature. The multispectral data were processed on an analog computer to detect moisture-stressed vegetation and surface temperatures. The results were printed on film to show the patterns of the hydrogeologic indicators. Terrain temperature patterns when compared with moisture-stressed vegetation patterns, show distinctive patterns which correlate with areas of known sinkhole activity in the Bartow area. (Knapp-USGS) W71-07963

DIRECT DETERMINATION OF THE ELEC-TROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 10 TO THE 8TH POWER TO 4 x 10 TO THE 9TH POWER

HERTZ,
Hawaii Univ., Honolulu. Water Resources
Research Center.
Larry K. Lepley.
PhD Thesis in Geosciences - Geophysics, Dec

1970. 115 p, 50 fig, 46 ref. OWRR Project B-015-

Descriptors: *Remote sensing, Brackish water, Electromagnetic wáves, *Radar, *Salinity, Estua-ries, *Hawaii, Springs, Roughness (Hydraulic), Waves, Geophysics, *Chlorinity. Identifiers: Radio spectrum, Microwave spectrum, Aerial techniques, Reflectance.

A preliminary study of the electromagnetic properties of aqueous sodium chloride, computergenerated frequency dispersion curves of (1) the dielectric coefficients, (2) power reflectance, (3) brightness temperature, and (4) skin depth of water as a function of eight different normalities of sodium chloride corresponding to a salinity range from pure to ocean water, and as a function of five different temperatures from 0C to 40C to the radio frequency range from 10 to the 6th power to 3 x 10 to the 10th power Hertz were constructed. These graphs indicate that the frequency dispersion of the reflectance of radio energy in the 10 to the 6th power to 10 to the 9th power Hertz band at normal incidence to a smooth water surface is strongly influenced by the salinity of the water, and that the spectral signature could be used as a measure of water salinity as distinguished from water temperature. Reflectance spectra from 2.5 x 10 to the 9th power to 4.0 x 10 to the 9th power Hertz of fresh and sea water were obtained with a free-wave (horn antenna and pool) system and reflectance spectra of brackish and sea water from 10 to the 8th power to 2.0 x 10 to the 9th power Hertz and of fresh water from 0.8 x 10 to the 9th power to 2 x 10 to the 9th power Hertz were obtained with a coaxial waveguide system. The measured spectral signatures appear to agree with the computed reflectance of aqueous sodium chloride solutions. The theoretical and experimental results indicate that free-wave radio reflectance spectrometry from 10 to the 6th power to 10 to the 9th power Hertz is feasible for use in remote sensing of salinity of fresh and brackish water outflows onto sea water.

DETERMINATION OF THE ACTIVITY OF HETEROTROPHIC MICROFLORA IN THE OCEAN USING C-14-CONTAINING ORGANIC MATTER,

Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.

For primary bibliographic entry see Field 05C. W71-08042

APPLICATION OF AN ACOUSTIC STREAM-FLOW-MEASURING SYSTEM ON THE COLUMBIA RIVER AT THE DALLES, OREGON.

Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 02E. W71-08056

THERMAL MAPPING OF STREAMS FROM AIRBORNE RADIOMETRIC SCANNING,

Purdue Univ., Lafayette, Ind. Dept. of Geosciences; and Purdue Univ., Lafayette, Ind. Lab. for Application of Remote Sensing. B. Houston Atwell, R. B. MacDonald, and Luis A. Bartolucci.

Water Resources Bulletin, Vol 7, No 2, p 228-243, Apr 1971, 16 p, 8 fig. 1 tab, 6 ref. NASA Grant NGR 15-005-112; USDA Contract 12-14-100-10292.

Descriptors: *Remote sensing, *Water temperature, Solar radiation, Infrared radiation, Data collections, Data processing.

Identifiers: Thermal mapping.

A brief review of radiation theory is applied to water temperature determinations. Errors introduced in radiant temperature measurements due to nonblackness of the water surface and the effects of the atmosphere are included in this discussion. An airborne scanner system and analysis and sion. An airoome scanner system and analysis and display of scanner data using the Laboratory for Applications of Remote Sensing (LARS) display system are discussed. Thermal maps of four sections of the Wabash River are used as examples of the system's output, and points of interest of each map are discussed. (Knapp-USGS) W71-08061

AIRCRAFT GAMMA-RAY SURVEY OF SNOW

Hydrometeorological Service of the USSR,

Moscow. A. V. Dmitriev, R. M. Kogan, M. B. Nikiforov, and

Sh. D. Fridman. Nordic Hydrology, Vol 2, No 1, p 47-56, 1971. 10 p, 2 fig, 2 tab, 5 ref.

Descriptors: *Snow surveys, *Remote sensing, *Gamma rays, *Nuclear moisture meters, *Water equivalent, Radioactivity techniques, Surveys, Data collections, Instrumentation, Aircraft, Snowacks, Snow cover, Calibrations. Identifiers: Snow mapping.

The physical basis for and the various methods of measuring the water equivalent of the snow cover by means of gamma-rays survey from aircraft are discussed. The gamma radiation from natural radionuclides in the soil does not vary with time and by measuring the absorption of this radiation by the snow cover the water equivalent of the snow can be determined. The attenuation of the gamma radiation depends only on the total mass of water. It does not depend on the state of the water, whether snow, ice or melt water. The gamma-ray field does depend however on the soil moisture content in the top 30 cm to some extent. Experience shows that the average water equivalent of the snow cover over large areas can be determined with satisfactory accuracy with the gamma-ray survey method from an aircraft, and that the results are in fact more reliable than conventional snow surveys on the ground. This is due to the fact that the small irregularities in the snow cover are to a large extent evened out when measured from the air. (Knapp-USGS) W71-08085

FIELD DETERMINATION OF BACTERIAL DIS-APPEARANCE IN SEAWATER,

Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering For primary bibliographic entry see Field 05A. W71-08160

7C. Evaluation, Processing and Publication

REDUCING EXCESS READOUTS DIGITAL STREAMFLOW RECORDERS,

Rocky Mountain Forest and Range Experimental Station, Tempe, Ariz. Hydrology Lab. Alden R. Hibbert, and Wilson B. Casner. Water Resources Research, Vol 7, No 2, p 415-418, Apr 1971. 4 p, 2 fig, 1 ref.

Descriptors: *Data processing, *Stream gages, *Data collections, *Computer programs, *Hydrographs, Water levels, Water level fluctuations, Stage-discharge relations.
Identifiers: *Streamflow recorders.

Digital water level recorders on small, flashy streams are frequently set at 5-minute readout intervals to define fluctuations during critical storm flow periods. Consequently, during nonstorm periods far more data points are punched on the recorder tapes than are needed to define the longterm hydrograph. A two-step reduction process eliminates more than 95% of the original 105,000 data points per year of record. The first reduction is obtained by translating to IBM cards only every twelfth (hourly) head value punched on the tape during nonstorm periods. Storm periods are translated at 5-minute intervals. A computer reduction step on both hourly and 5-minute data then systematically rejects head values not essential to hydromatically rejects head values not essential to hydro-graph definition. Rejection is based on differences in elevation and slope between successive head values. Computer output consists of cards and a listing of the reduced data. (Knapp-USGS)

FLOODS IN PATILLAS-MAUNABO AREA, PUERTO RICO,

Geological Survey, Washington, D.C. William J. Haire.

For sale by US Geological Survey, Washington, DC, 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-445, 1 sheet, 1971. Text, 5 fig, 1 map, 1 photo, 5 ref.

Descriptors: *Floods, *Puerto Rico, Profiles, Stage-discharge relations, Flood damage, Maps, Mapping, Flood plains, Rainfall-runoff relationships, Hydrograph analysis, Depth-area-duration analysis, Planning, Zoning, Coastal plains. Identifiers: Patillas (PR), *Maunabo (PR), Hydrolapia et les Hydrologic atlas.

This one-sheet hydrologic atlas is one of a series of four that covers the south coast of Puerto Rico between Ponce and Maunabo. This atlas shows the water-surface profiles and areas inundated by the October 1970 flood and contains information pertaining to previous floods that are hydrologically significant. The report has been prepared to provide a technical basis on which individuals, organizations, and governmental agencies can make decisions leading to development on the flood plain compatible with the degree for flood risk. Floods occurred on most streams in Puerto Rico during the period October 5-10, 1970. The greatest floods occurred in the eastern two-thirds of Puerto Rico. The floods of October 1970 were outstanding because of their duration and multiple peaks. The volume of runoff was extraordinarily large. The floods resulted from rainfall that totaled as much as 35 inches at some places during the 6-day period. The rainfall came mostly in intense bursts. The larger streams of the southern slope rise on the Cordillera Central, which is primary drainage divide of Puerto Rico. The channels are very steep in the mountains, and their slopes become progressively less steep in the roothills and on the coastal plain. (Knapp-USGS)
W71-07926

GROUNDWATER HYDROLOGY OF THE MESCALERO APACHE INDIAN RESERVA-TION, SOUTH-CENTRAL NEW MEXICO, Geological Survey, Washington, D.C. C. E. Sloan and M. S. Garber.

C. E. Sloan and M. S. Garber. For sale by US Geological Survey, Washington, DC, 20242, Price 75 cents. Geological Survey Hydrologic Investigations Atlas HA-349, 1 sheet, 1971. Text, 2 fig, 4 map, 2 tab, 7 ref.

Descriptors: *Water resources development, *Groundwater, *Hydrogeology, *Withdrawal, *New Mexico, Water wells, Hydrologic data, Aquifers, Aquifer characteristics, Water levels, Water yield, Water quality, Chemical analysis, Precipitation (Atmospheric), Drainage, Climatolo-

Identifiers: *Groundwater resources (N. Mex).

Groundwater hydrology of the Mescalero Apache Indian Reservation, South-Central New Mexico is shown by a one-sheet hydrologic atlas consisting of a generalized geologic map and section, a map showing water levels and location of wells and springs, a map showing approximate distribution of precipitation, an illustration showing a generalized stratigraphic column, tables of chemical analyses of water from springs and wells, and a descriptive text. The Yeso Formation of Permain age is the most extensive aquifer in the reservation, with yields to wells from less than I gpm to more than 500 gpm. Total dissolved solids in water samples from the Yeso formation ranged from 358 to 2,210 mg/liter. Analyses of water from wells and springs on the Mescalero Reservation show dissolved solids content ranging from 358 mg/liter to 3,909 mg/liter. The water is generally of the calcium-magnesium sulfate or bicarbonate type with hardness generally ranging from 300 to 2,000 mg/liter. (Woodard-USGS)

GROUNDWATER RESOURCES OF WALSH COUNTY, NORTHEASTERN NORTH DAKOTA, Geological Survey, Washington, D.C.

Joe S. Downey

For sale by US Geological Survey, Washington, DC, 20242, Price \$1.00. Geological Survey Hydrologic Investigations HA-431, 1 sheet, 1971. Text, 1 fig, 3 map, 2 tab, 6 ref.

Descriptors: *Water resources development, *Groundwater, *Hydrogeology, *Withdrawal, *North Dakota, Hydrologic data, Water wells, Aquifers, Aquifer characteristics, Water levels, Water yield, Water quality, Chemical analysis, Hydrographs.
Identifiers: *Groundwater resources, *Walsh

County (ND).

This one-sheet (34 x 29 inches) hydrologic atlas consisting of illustrations, tables, maps, and a descriptive text summarizes groundwater resources in Walsh County in northeastern North Dakota.

The county is almost entirely covered by glacial drift of till and glaciofluvial deposits ranging in thickness from about 300 feet in the eastern part of the county to about 30 feet in the western part. The largest and most productive glacial-drift aquifer is located near the city of Fordville, and is locally known as the Fordvilleaquifer. Four bedrock units supply water to wells in the Walsh County. The Pierre Shale yields from 1 to 5 gpm from fracture zones in the upper part of the formation. Wells tapping the Dakota Sandstone have been reported to yield as much as 500 gpm. Water from the Jurassic and Paleozoic bedrock formations is very saline and is unsatisfactory for most uses. Wells tapping the glacial-drift aquifers in Walsh County yield water with a wide range of chemical quality. (Woodard-USGS)

FLOODS IN SALINAS AREA, PUERTO RICO,

Geological Survey, Washington, D.C. William J. Haire.

For sale by US Geological Survey, Washington, DC, 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-477, 1 sheet, 1971. Text, 4 fig, 1 photo, 1 map, 5 ref.

Descriptors: *Floods, *Puerto Rico, Profiles, Stage-discharge relations, Flood damage, Maps, Mapping, Flood plains, Rainfall-runoff relationships, Hydrograph analysis, Depth-area-duration analysis, Planning, Zoning, Coastal plains. Identifiers: *Salinas (PR), Hydrologic Atlas.

This one-sheet hydrological atlas covers the south coast of Puerto Rico between Ponce and Maunabo. It shows the water-surface profiles and areas inundated by the October 1970 flood and contains information pertaining to previous floods that are hydrologically significant. Floods occurred on most streams during the period October 5-10, 1970. The greatest floods occurred in an area east of a line extending from Arecibo to Ponce, which is the east-ern two-thirds of Puerto Rico. Higher floods have occurred in other years in some areas but the floods of October 1970 were outstanding because of their duration and multiple peaks. The floods resulted from rainfall that totaled as much as 35 in at some places during the 6-day period. Rainfall came mostly in intense bursts. The drainage area of Rio

Nigua is about 53 sq mi at the mouth at Mar Caribe. Rio Nigua flows across one of the most distinctive alluvial fans on the south coast. There are small diversion structures in Rio Lapa and Rio Majada for irrigation and water supply, but their storage capacity is negligible. The profile for the flood of October 1970 is shown and the flooded area is delineated on the map. The flood of August area is delineated on the map. The flood of August 1956 was slightly higher than the 1970 flood. The September 1928 flood, however, was 1 to 1.5 meters higher than the 1970 flood in the upper part of the coastal plain. The peak discharge of Rio Lapa near the mouth during the flood of October 1970 was 7,300 cfs (cubic feet per second), an average of 737 cfs per square mile of drainage area. The peak discharge of Rio Majada near its mouth was 13,000 cfs, an average of 580 cfs per square mile. (Knapp-USGS) W71-07929

WATER-RESOURCES RECONNAISSANCE OF A PART OF THE MATANUSKA-SUSITNA BOROUGH, ALASKA, Geological Survey, Washington, D.C.

Alvin J. Feulner.

Alvin J. Feulner. For sale by the US Geological Survey, Washington, DC, 20242, Price 50 cents. Geological Survey Hydrologic Investigations Atlas HA364, 1 sheet, 1971. Text, 5 fig, 3 map, 2 tab, 3 ref.

Descriptors: *Water resources development, *Sur-Descriptors: *Water resources development, *Surface waters, *Groundwater, *Hydrogeology, *Alaska, Streamflow, Runoff, Aquifers, Aquifer characteristics, Water yield, Water levels, Water quality, Chemical analysis, Precipitation (Atmospheric), Hydrologic data, Water wells, Withdrawal, Surface-groundwater relationships. Identifiers: *Water resources (Alas).

This one-sheet hydrologic atlas consisting of maps, graphs, tables of data, and a descriptive text summarizes the groundwater and surface water resources of the Matanuska-Susitna Borough, Alaska. Average cumulative discharge of all measured streams in the study area was about 28,000 cfs. The greatest yields of groundwater (more than 100 gpm) comes from wells in the flood plains and lowland areas adjacent to streams and rivers. These areas are underlain by glacial and alluvial deposits of sand and gravel. Groundwater in the study area has a greater chemical-quality variation than the surface water. It generally is harder than surface water, except in areas adjacent to streams where the water quality of both is similar. Much of the groundwater obtained from shallow wells drilled in the alluvium contains objectionable concentrations of iron, most of which could be easily removed by aeration and filtration of the water prior to storage or use. Groundwater ranges from about 50 to more than 200 mg/liter in hardness and is of the calcium bicarbonate type. (Woodard-USGS)

FLOODS IN GUAYAMA AREA, PUERTO RICO,

Geological Survey, Washington, D.C.

William J. Haire.

For sale by US Goological Survey, Washington, DC, 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-446, 1 sheet, 1971. Text, 7 fig, 1 map, 1 tab, 5 ref.

Descriptors: *Floods, *Puerto Rico, Profiles, Stage-discharge relations, Flood damage, Maps, Mapping, Flood plains, Rainfall-runoff relationships, Hydrograph analysis, Depth-area-duration analysis, Planning, Zoning, Coastal plains. Identifiers: *Guayama (PR), Hydrologic atlas.

This one-sheet hydrologic atlas is one of a series of four that covers the south coast of Puerto Rico between Ponce and Maunabo. This atlas shows the water-surface profiles and areas inundated by the October 1970 flood and contains information pertaining to previous floods that are hydrologically significant. The report has been prepared to provide a technical basis on which individuals, organizations, and governmental agencies can make

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decisions leading to development on the flood plain compatible with the degree of flood risk. Floods occurred on most streams in Puerto Rico during the period October 5-10, 1970. The greatest floods occurred in the eastern two-thirds of Puerto Rico. The floods of October 1970 were outstanding because of their duration and multiple peaks. The volume of runoff was extraordinarily large. The floods resulted from rainfall that totaled as much as 35 inches at some places during the 6-day period. The rainfall came mostly in intense bursts. (Knapp-W71-07931

FLOODS IN SANTA ISABEL AREA, PUERTO

Geological Survey, Washington, D.C.

William J. Haire

For sale by US Geological Survey, Washington, DC, 20242, Price \$1.00. Geological Survey Hydrologic Investigations Atlas HA-448, 1 sheet, 1971. Text, 7 fig, 1 map, 2 photo, 5 ref.

Descriptors: *Floods, *Puerto Rico, Profiles, Stage-discharge relations, Flood damage, Maps, Mapping, Flood plains, Rainfall-runoff relationships, Hydrograph analysis, Depth-area-duration analysis, Planning, Zoning, Coastal plains. Identifiers: *Santa Isabel (PR), Hydrologic atlas.

This one-sheet hydrological atlas is one of a series of four that covers the southern coast of Puerto Rico between Ponce and Maunabo. This atlas shows the water-surface profiles and areas inundated by the October 1970 flood and contains information pertaining to previous floods that are hydrologically significant. The report has been prepared to provide a technical basis on which individuals, organizations, and governmental agencies can make decisions leading to development on the flood plain compatible with the degree of flood risk. Floods occurred on most streams in Puerto Rico during the period October 5-10, 1970. The greatest floods, however, occurred in the eastern two-thirds of Puerto Rico. The floods of October 1970 were outstanding because of their duration and multiple peaks. The volume of runoff was extraordinarily large. The floods resulted from rainfall that totaled as much as 35 inches at some places during the 6-day period. The rainfall came mostly in intense bursts. A profile of the flood of October 1970 is shown. (Knapp-USGS) W71-07932

HYDROLOGICAL FORECASTS AND MODERN COMPUTERS.

Gidromteorologicheskii Nauchno-Inssledovatelsii Tsentr, Moscow (USSR).

For primary bibliographic entry see Field 04A. W71-07948

COMPUTER SIMULATION OF CLINCH MOUNTAIN DRAINAGE NETWORKS, IBM Thomas Watson Research Center, Yorktown

Heights, N.Y For primary bibliographic entry see Field ()4A

COST OF MUNICIPAL SEWAGE TREATMENT PLANTS IN ILLINOIS,

Illinois State Water Survey, Urbana. Thomas A. Butts, and Ralph L. Evans. State of Illinois, Department of Registration and Education Circular 99. 37 p, 16 fig, 12 tab, 5 ref.

Descriptors: *Comparative costs, Least squares method, *Regression analysis, *Waste water treatment, Water quality control, *Illinois, *Cost analysis, Construction costs, Maintenance costs, Operating costs, Trickling filters, Lagoons, Activated sludge, Digestion, Sludge, Costs, *Scwage treat-

Identifiers: Municipal waste water.

Municipal sewage treatment facility costs for 291 plants constructed in Illinois between 1957 to 1968 are summarized. The eight categories of new plants analyzed are: (1) lagoons, (2) primary with heated digesters' (3) primary with vacuum filters' (4) trickling filter-digester; (5) trickling filter-Imhoff tank; (6) activated sludge, constructed in place, having population equivalents (P.E.) equal to or less than 10,000; (7) activated sludge, constructed in place, having a P.E. of greater than 10,000; and (8) factory built activated sludge units. Mean unit treatment costs in dollars/P.E. were obtained using the least squares regression analysis, considering construction, operating and land costs in the general geometric form of C — KPn, where C is either construction, operating, or land costs, K is a regression constant, P is the sewage treatment design capacity, and n is the slope of the least squares regression line. Two categories were also established for plant additions, namely trickling filter or activated sludge additions. The regression equation formulated for additions was of the form - KPnSm, where C- cost of the addition, K- a regression constant, P- capacity of new addition, S- capacity of existing plant, and n,m& slope constants. Several examples of the applications of the preceding equations were included, along with a table which summarized the relative costs predicted through use of the equations. This cost analysis procedure was not designed to replace an indepth engineering study for determining costs. However, use of the formulae presented will allow concerned parties to obtain a quick estimate of the relative costs of the various treatment schemes. (Lowry-Texas) W71-07994

EARTH RESOURCES RESEARCH DATA FACILITY INDEX: VOLUME I, DOCUMENTARY DATA; VOLUME II, SENSOR DATA.
National Aeronautics and Space Administration,

Houston, Tex. Manned Spacecraft Center.

NASA Manned Spacecraft Center Publication MSC-02576 (2 Vols), Jan 1971. 506 p (Vol I); 219 p (Vol II).

Descriptors: *Data collections, *Information retrieval, *Resources, *Remote sensing, *Satellites (Artificial), Acrial photography, Bibliographies, Documentation, Publications, Natural resources. Identifiers: *Earth Resources Data Index.

This document, presented in 2 volumes, is the cumulative issue of the Earth Resources Research Data Facility (ERRDF) Index. Volume I lists all Earth Resources Program documentary information that is available at the National Aeronautics and Space Administration's Manned Spacecraft Center. Included in Volume II of the Index are sensor data collected during flights over test sites and from missions flown by subcontractors supporting the Earth Resources Survey Program. The information cataloged in the 2 volumes of this document is divided into 5 major data catagories as follows: Vol. I, Part 1 - Technical documents and maps; Part 2 - Satellite data; Vol. II, Part 3 - Functional and check out data; Part 4 - Imagery data; and Part 5 - Electronic data. (Knapp-USGS) W71-08046

FLOOD STAGES AND DISCHARGES FOR SMALL STREAMS IN TEXAS,

Geological Survey, Austin, Tex.

E. E. Schroeder.

Interim Report 85-4 (Geological Survey Texas District Open-file Report No 124), 1971. 319 p, 6 fig,

Descriptors: *Streamflow, *Floods, *Peak discharge, *Flow measurement, *Texas, Flow rates, Discharge (Water), Rainfall-runoff relationships, Stream gages, Gaging stations, Rain gages, Data collections, Hydrologic data, watersheds.

This report is the fourth in a series of interim reports that describe the objectives, planning of the project, the instrumentation, the progress and status of the project, and the data collected during the water year (Oct. 1, 1967-Sept. 30, 1968), for small streams (less than 20 square miles drainage area) in Texas. A typical installation consists of two crest-stage gages; one headwater gage, and one tail-water gage. The headwater gage is located up-stream from the culvert at a distance approximately equal to one culvert width in order to record the true water-surface elevation upstream from any drawdown-zone disturbance. The tailwater gage is located downstream from the culvert to record the water-surface elevation at the culvert outlet. The differential head, determined from the difference in the recorded headwater and tailwater peaks, is then converted into a peak rate of flow by standard U.S. Geological Survey methods of computation. Additional hydrologic data are obtained at each site by a stage and rainfall recorder. (Woodard-USGS) W71-08047

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA, VOL 2, BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY. Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$3.25. Geological Survey Water-Supply Paper 1929, 1970. 673 p, 1 fig, 1 plate.

Descriptors: *Hydrologic data, *Data collections, *Streamflow, *Stream gages, *California, Surface waters, Flow rates, Average flow, Low flow, Peak discharge, Flow measurement, Reservoir stages, Lakes, Gaging stations, Discharge measurement. Identifiers: *Pacific Slope Basins (Calif).

This volume of surface water supply for the Pacific Slope Basins in California from Arroyo Grande to Oregon stateline, except Central Valley, is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations include discharge measurements at low-flow partial-record stations, and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W71-08048

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 12. PACIFIC SLOPE BASINS IN WASHINGTON, VOL. 1. PACIFIC SLOPE BASINS IN WASHINGTON EXCEPT COLUMBIA RIVER BASIN.

Geological Survey, Washington, D.C.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$3.50. Geological Survey Water-Supply Paper 1932, 1971. 679 p, 1 fig, 1 plate.

Descriptors: *Streamflow, *Hydrologic *Data collections, *Stream gages, *Washington, Surface waters, Discharge measurement, Flow rates, Average flow, Low flow, Peak discharge, Gaging stations, Reservoir stages, Lakes. Identifiers: *Pacific Slope Basins (Wash).

This volume of surface water supply for Pacific Slope Basins in Washington, except Columbia Basin, is one of a series of 37 reports presenting records of stage, discharge, and content of streams,

lakes, and reservoirs in the United States during the lakes, and reservoirs in the United States during the 1961-65 water years. The tables of data include a description of the gaging station, and daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs, a description of the station and a monthly summary table of stage and contents. and a monthly summary table of stage and contents are given. Data for partial-record stations include discharge measurements at low-flow partial-record stations, and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W71-08049

NATIONWIDE STUDY OF THE STREAMFLOW

DATA PROGRAM,
Geological Survey, Washington, D.C.
R. W. Carter, and M. A. Benson.
Water Resources Bulletin, Vol 7, No 2, p 383-385, Apr 1971. 3 p, 1 tab.

Descriptors: *Data collections, *Hydrologic data, *Gaging stations, Reviews, Surveys, Data processing, Instrumentation, Networks, Evalua-Surveys, Data tion, Performance, Planning.
Identifiers: US Geological Survey, *Streamflow

data programs.

During 1970 the Geological Survey conducted a study to evaluate the surface-water data collection program. Objectives were formulated, specific goals were set, a massive analysis of available data was made to determine the extent to which the present system enables the goals to be met, alternatives were considered for meeting the remaining goals, and finally, specific elements were identified for inclusion in the future program. The results of the evaluation are used in planning the streamflow data program. Less productive elements in the present program can be weeded out, and the effort devoted to more critically needed water data. The study provides the groundwork for direction of efforts towards a more efficient system for satisfying present and future needs. (Knapp-USGS) W71-08059

SUMMARY OF SNOW SURVEY MEASURE-MENTS FOR ARIZONA AND PERTINENT POR-TIONS OF NEW MEXICO 1939-1970,

Soil Conservation Service, Phoenix, Ariz For primary bibliographic entry see Field 02C. W71-08076

SELECTED WATER RESOURCE RECORDS FOR OKALOOSA COUNTY AND ADJACENT AREAS.

Geological Survey, Tallahassee, Fla. James B. Foster, and Charles A. Pascale. Florida Bureau of Geology Information Circular No 67, 1971. 95 p, 4 fig, 9 tab, 9 ref.

Descriptors: *Surface waters, *Groundwater, *Hydrologic data, *Data collections, *Florida, Water resources, Rainfall, Stream gages, Chemical analysis, Water temperature, Water wells, Water levels, Pumping, Geology, Petrology, Hydrogeology, Aquifer characteristics, Aquifers, Hydrology. Identifiers: *Okaloosa County (Fla), Lithologic logs, Streamflow measurements.

Water resources records are presented for Okaloosa County, Florida, the upper drainage area of Shoal River, coastal areas in Walton County, and selected areas in Santa Rosa County. These records were collected from January 1966 through September 1968. Geologic and hydrologic information are presented in tables which group the data according to type. Maps of the area show the location of data collection stations within the county and adjacent areas. The tabulated surface-water data include station numbers, streamflow measure-ments, chemical analyses, and water temperatures. Groundwater records include wells inventoried, water levels, pumpage, chemical analyses, water

temperatures, and lithologic logs. Rainfall data are compiled, and the location of the rain gages are shown. (Woodard-USGS)
W71-08114

LOW-FLOW FREQUENCY OF WISCONSIN

STREAMS, Geological Survey, Washington, D.C. Warren A. Gebert

For sale by US Geological Survey, Washington, DC, 20402, Price \$0.75 cents. Geological Survey Hydrologic Investigations Atlas HA-390, 1 sheet, 1971. Text, 3 fig, 1 map, 14 ref.

Descriptors: *Streamflow, *Low flow, *Frequency analysis, *Wisconsin, Stream gages, Flow characteristics, Discharge measurement, Gaging stations, Hydrographs, Water resources development, Base

Identifiers: *Low-flow variability.

This one-sheet hydrologic atlas presents low-flow characteristics at 320 streamflow stations in Wisconsin. Knowledge of the magnitude and frequency of recurrence of low flows of streams is useful for planning, managing, and protecting the State's water resources. Planning and regulatory agencies can use low-flow frequency information for allocating water rights, administering water uses, developing water projects, and determining the availability of water. Industries and municipalities can use the information in seeking water supplies, as well as in determining the capacities of streams to dilute wastes. (Woodard-USGS) W71-08115

SELECTED FLOW CHARACTERISTICS OF FLORIDA STREAMS AND CANALS,

Geological Survey, Tallahassee, Fla. Richard C. Heath, and E. Turner Wimberly. Florida Bureau of Geology Information Circular No 69, 1971. 595 p, 7 fig, 8 ref.

Descriptors: *Streamflow, *Flow characteristics, *Stream gages, *Hydrologic data, *Florida, Data collections, Discharge measurement, Low flow, Peak discharge, Duration curves, Average flow, Gaging stations, Reviews.
Identifiers: *Streamflow basic data (Fla).

Tables of flow duration, lowest mean discharge, and highest mean discharge for selected consecutive periods within each year through September 30, 1965, at 254 stream-gaging stations on Florida streams are presented. These tables summarize daily streamflow records needed to define flow characteristics at stream-gaging sites. The content of each of the three summary tables is described, and techniques for preparing flow-duration curves, and low-flow and high-flow frequency curves are explained. (Woodard-USGS)

08. ENGINEERING WORKS

8A. Structures

OPERATING FORCES ON MITER-TYPE LOCK GATES.

Army Engineer Waterways Experiment Station,

Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-07782

SPILLWAY FOR TYPICAL LOW-HEAD NAVIGATION DAM ARKANSAS RIVER, AR-KANSAS. HYDRAULIC MODEL INVESTIGA-

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B.

PROTECTION OF NARRAGANSETT BAY FROM HURRICANE SURGES, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. For primary bibliographic entry see Field 08B.

W71-07784

SPILLWAY FOR OAHE DAM MISSOURI RIVER, SOUTH DAKOTA,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07785

WAVE ACTION AND BREAKWATER LOCA-TION, HALF MOON BAY HARBOR, HALF MOON BAY, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07786

NAVIGATION CONDITIONS AT MAXWELL LOCKS AND DAM, MONONGAHELA RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07787

SPILLWAY, MILLERS FERRY LOCK AND

DAM, ALABAMA RIVER, ALABAMA, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07788

SPILLWAY FOR PROCTOR DAM, LEON

RIVER, TEXAS, Army Engineer Waterways Experiment Station, Vicksburg, Miss

For primary bibliographic entry see Field 08B. W71-07790

EFFECTS ON LAKE PONTCHARTRAIN, LA., OF HURRICANE SURGE CONTROL STRUC-TURES AND MISSISSIPPI RIVER-GULF OUT-LET CHANNEL, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07791

TYPICAL SPILLWAY STRUCTURE FOR CEN-TRAL AND SOUTHERN FLORIDA WATER-CONTROL PROJECT,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B.

SPILLWAY MODIFICATIONS, MIRAFLORES DAM, PANAMA CANAL ZONE: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B. W71-07798

SPILLWAY FOR STOCKTON DAM, SAC RIVER, MISSOURI: HYDRAULIC MODEL IN-VESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08B.

Field 08—ENGINEERING WORKS

Group 8A—Structures

WASHED OUT ROAD REOPENED QUICKLY.

Public Works, Vol 101, No 8, p 84, Aug 1970. 3

Descriptors: *Construction, *Steel pipes, *Installation, *Construction materials.

This article describes how a concrete slab deck culvert, destroyed by a flash flood, was replaced in only eleven working days with two 90-inch corrugated galvanized steel pipes. The contractor laid the pipe employing all standard practices except for the special borrow gravel used for the entire fill. It is normally used only halfway up the pipe. W71-07857

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NEW JERSEY.

Corps of Engineers, New York. North Atlantic Div. For primary bibliographic entry see Field 04A.

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN DELAWARE.

Corps of Engineers, New York. North Atlantic Div. For primary bibliographic entry see Field 04A. W71-07925

SNOW FENCES.

Road Research Lab., Crowthorne, England, Climate and Environment Section. For primary bibliographic entry see Field 02C. W71-08069

THE LAYOUT OF NEW NAVIGABLE WATER-

Administration des Ponts et Chausees, Paris (France).

Bulletin of the Permanent International Association of Navigation Congresses (PIANC), Vol 4, No 6, p 17-39, 1970. 23 p, 17 fig, 6 tab, 3 append.

Descriptors: *Navigable waters, *Locks, *Hydraulic structures, *Navigation, *Inland waterways, Engineering structures, Canals, Tunnels, Ships, Costs, Hydraulic transportation, Planning. Identifiers: *France.

New approaches to improving and increasing navigable waterways in France are discussed under the following topics: (1) Canalization of rivers; (2) Tunnels; (3) Locks and elevators; (4) Negotiation of a crest by a canal; and (5) Water slope. The estimated costs of constructing and maintaining the facilities are given. The value of shipping time is formulated on the basis of time lost by a ship passing through a lock. For example, with a traffic of 10 million tons per annum, after making allowance for unavoidable periods of waiting, the average time lost is 50 minutes for a lock with a 10 m fall. This figure varies by one minute more or less per meter according to whether the fall is greater or smaller. A ship's average load is 2,000 tons, and the number of ships passing through the lock in a year is 5,000. One hour of lost time suffered by a ship represents a loss of 200 francs. The annual loss for one hour's delay amounts to: 200 X 5,000 — 1,000,000 francs. The total time value per meter of fall for the various lock fall heights are shown. (Woodard-USGS) W71-08120

SEISMIC ACTIVITY IN THE VICINITY OF SAN LUIS RESERVOIR.

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

For primary bibliographic entry see Field 08D.

W71-08170

FEASIBILITY STUDY OF WATER IMPOUND-MENTS, MESCALERO APACHE INDIAN RESERVATION, SOUTH CENTRAL NEW MEX-

Boyle Engineering, Ventura, Calif. For primary bibliographic entry see Field 06B. W71-08172

THE USE OF SYSTEMS ANALYSIS IN THE DEVELOPMENT OF WATER RESOURCES MANAGEMENT PLANS FOR NEW YORK STATE.

New York State Department of Environmental Conservation, Albany. Div. of Water Resources. A. C. Tedrow, C. S. Liu, D. B. Halton, and R. A. Hiney.

Available from the National Technical Information Service as PB-199 539, \$3.00 in paper copy, \$0.95 in microfiche. Vol I, June 1970. 183 p, 36 fig, 11 tab, 18 ref. OWRR Project C-1126 (No 1586) (1).

Descriptors: *Systems analysis, *Optimization, *Dynamic programming, *Simulation analysis, *Water management (Applied), Multiple-purpose projects, River basins, Flood control, Mathematical models, Computer programs, Water resources development, Operations research. Identifiers: Oswego River Basin.

A research project was developed to evaluate the use of systems analysis techniques in New York State's multiple purpose comprehensive water resources planning program. In conjunction with an on-going planning study, hydrologic models were developed for evaluation of various manage-ment schemes. The Oswego River Basin, located in central New York, was used as the vehicle for carrying out the project. In applying systems analysis techniques to the river basin, a number of models were constructed. Management programs were analyzed on two different time bases; one, an overall budgeting or allocating of waters to various purposes on a long time interval and the other, the operation of the physical system on a transient basis during flood periods. As a result, a monthly or 'conservation' simulation model, a monthly op-timization model, and a flood simulation model were developed. Dynamic programming was applied to optimize the diversion operations and Hook's pattern search method optimized the storage operations for the multiple purpose river system. The 'conservation' model simulated the hydraulic operation of the lakes and water courses outlines. The flood routing model was a mathematical representation of a hydraulic system and consisted of the lakes and reservoirs in the Oswego River Basin and their connecting waterways. The models provided an excellent framework for management of the planning study, specifying data needs, and priorities on development of informa-tion. (See also W71-08186) (Kriss-Cornell) W71-08185

8B. Hydraulics

OPERATING FORCES ON MITER-TYPE LOCK GATES.

Army Engineer Waterways Experiment Station, Vicksburg, Miss. J. L. Grace, Jr., T. E. Murphy, and F. R. Brown.

Available from the National Technical Information Service as AD-718 219, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-651, June 64. 130 p.

Descriptors: *Locks, *Gates, *Pressure, *Canels, Inland waterways.

Identifiers: Kinematics, Torque, Panama, Miter type lock gates.

Tests to determine the force required to move miter-type lock gates throughout the opening and closing cycles were conducted in a flume with a single set of miter gates located approximately in its center. Three linkages, with different kinematics of the operating machinery, were studied (modified

Ohio River, Panama, and Ohio River). Other varia-Ohio River, Panama, and Ohio River). Other valua-bles investigated were: submergence of gate; operating time; lock chamber length; bottom clearance of gate; barges in lock chamber; nonsynchronous operation of gate leaves. Peak hydraulic resistance to operation occurred as the leaves entered and left the closed position. The modified Ohio River and Panama linkages resulted to neak resistance in terms of torque at the nintless. in peak resistance in terms of torque at the pintles about equal and 40 percent less than those of the Ohio River linkage. Increased submergence of the leaves or speed of operation increased hydraulic resistance, as did decreases in gate bottom clearance. Hydraulic resistance decreased as lock chamber length increased. Nonsynchronous operation of the gates slightly reduced peak torque. Barges in the lock chamber had no effect on torque values. A report by the Panama Canal on earlier model tests of the Panama linkage is included as Appendix A. (WES) W71-07782

SPILLWAY FOR TYPICAL LOW-HEAD NAVIGATION DAM ARKANSAS RIVER, AR-KANSAS. HYDRAULIC MODEL INVESTIGA-

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. L. Grace, Jr.

Available from the National Technical Information Service as AD-718 218, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report, 2-655 Sep 64, 162 p.

Descriptors: *Dams, *Model studies, *Flow, *Spillways, Concrete, Arkansas construction materials. Identifiers: Arkansas River, Riprap.

Investigations were conducted using 1:25-, 1:40-, Investigations were conducted using 1:25-, 1:40-, and 1:50-scale section models to determine optimum gate sill and pier nose shapes, spillway capacity with full and partial gate openings for both free and submerged flows, stilling basin performance, and riprap requirements for a typical low-head navigation dam such as planned for construction on the Arkansas River. Test results indicated that: (a) the parabola, X2 — 40Y, is the optimum gate sill shape: (b) an opival pier nose is optimum gate sill shape; (b) an ogival pier nose is slightly more efficient than a semicircular nose; (c) apron elevations in the range of elevations tested do not affect discharge characteristics; (d) one row of 4-ft-high baffle piers and a 3-on-4-sloping, 4-fthigh end sill comprise the optimum stilling basin; (e) riprap downstream of the stilling basin is most stable when placed on a slope of 1 on 6; and (f) extension of the gate piers from the toe of the gate sill to the end of the stilling basin produces a more uniform scour pattern in the exit channel. (WES) W71-07783

PROTECTION OF NARRAGANSETT BAY FROM HURRICANE SURGES, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

H. B. Simmons.

Available from the National Technical Information Service as AD-718 220, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-662, Oct 64, 122 p.

Descriptors: *Breakwaters, *Model studies, *Surges, *Ocean waves, Shore protection, Tides, Navigation, Barriers, Salinity. Identifiers: Tropical cyclones, Ocean currents, Military requirements, Hurricane surges, Providence (RI), Waste wash-out.

The design of barriers for protection of Narragansett Bay against inundation by hurricane surges required use of a comprehensive model to determine the effects of proposed structures on normal tide and hurricane surge heights, current velocities, the salinity regimen of the bay, and the rates of dif-fusion and flushing of pollutants discharged into the bay. Model tests indicated that barriers should not be located in the central portions of the bay because of excessive buildup of surge heights

downstream from such barriers, that a lower bay barrier alone could not satisfy the requirements of the Navy and at the same time afford the desired reductions in surge heights at upstream locations, but that the combination of a gated structure at Fox Point for the protection of Providence with a system of lower bay barriers with ungated openings could satisfy the requirements of the Navy for maximum current velocities and at the same time provide hurricane surge protection throughout the bay vide hurricane surge protection throughout the bay system. However, current velocities and patterns in ungated navigation openings would not be safe for navigation by all craft which use Narragansett Bay. The addition of gated openings in the East and West Passage barriers should provide a satisfactory solution to this problem. Such a plan should have no detrimental effects on the salinity regimen of the bay, the rates and patterns of diffusion and flushing of wastes, or on shoaling of the navigation channels. (WES) W71-07784

SPILLWAY FOR OAHE DAM MISSOURI RIVER, SOUTH DAKOTA,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. E. S. Melsheimer, and A. D. Rooke, Jr.

Available from the National Technical Information Service as AD-718 222, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-657, Sept

Descriptors: *Dams, *Model studies, *Flow, *Spillways, Shallow water, Concrete, Missouri, Weirs. Identifiers: Oahe Dam, Missouri River, Riprap.

The spillway, a low, broad-crested weir surmounted by 8 gates, will be operated when the pool reaches top-of-gate elevation; thus initial flows will discharge into a dry exit channel under a 23.5-ft head. A 1:50-scale model was used to study spillway performance when this structure is the control and supercritical flow predominates. A shallow (6.5-ft-deep), rectangular stilling basin was developed which dispersed small flows and eliminated surface waves at large flows. Also a gate operation schedule was developed which, together with the shallow basin, comprised the optimum method of controlling flows on the apron downstream until submergence occurred. Tests of the exit channel (a paved transition section and a riprap-protected section leading to the unlined channel) showed that sector walls could replace the concrete transitions below the rectangular basin, and that the paved apron and riprap section could be reduced in length. (WES)

WAVE ACTION AND BREAKWATER LOCATION, HALF MOON BAY HARBOR, HALF MOON BAY, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

H. B. Wilson.

Available from the National Technical Information Service as AD-718 678, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-668, Jan

Descriptors: *Breakwaters, *Model studies, *Occan waves, Test procedures, California, Hydrography, Deep water. Identifiers: Half Moon Bay (Calif).

The entire Half Moon Bay Harbor basin, the surrounding breakwater system with 600-ft-wide navigation entrance, and sufficient coastline and offshore hydrography to ensure accurate simulation of approaching waves were reproduced in a 1:100-scale hydraulic model equipped with wavegenerating and wave-height measuring devices. The model was used to determine the optimum location and length of breakwaters necessary to provide, at minimum cost, adequate protection for pleasure craft and fishing boats berthed at the piers during storm wave action. It was concluded that an

added section of rubble-mound breakwater about 1050 ft long, which would extend the existing west breakwater in a southeasterly direction and provide a revised navigation entrance about 350 ft wide, would ensure the desired protection. Alternate breakwater plans were developed that also satisfied the selected wave-height-duration criteria. However, these plans involved more costly structures or had some overriding objectionable feature not characteristic of the plan recommended for construction. (WES) W71-07786

NAVIGATION CONDITIONS AT MAXWELL LOCKS AND DAM, MONONGAHELA RIVER: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. J. Franco, and C. D. McKellar.

Available from the National Technical Information Service as AD-718 679, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-672 Jan 65. 73 p.

Descriptors: *Dams, *Model studies, *Navigation, *Locks, Test procedures, Pennsylvania, River flow. Identifiers: Multiphase flow, Flow fields, Monongahela River.

Maxwell Locks and Dam will consist of two parallel, 84- by 720-ft locks and a 460-ft-long, gated, nonnavigable dam. A 1:120-scale, fixed-bed model, reproducing about 2.4 miles of the relatively straight reach of the Monongahela proposed for the locks and damsite, was used to: (a) determine the most favorable site in the reach for the structures; (b) demonstrate flow conditions in the lock approaches; (c) assist in developing modifications of the approaches and structures to improve navigation conditions; and (d) determine flow and navigation conditions during the stages of construction of the locks and dam. Tests were concerned with the study of flow patterns, measurement of velocities in the lock approaches, and behavior of a model tow on entering and leaving the locks under flows ranging from 35,000 to 116,000 cfs. The results of the investigation indicated the following: (a) the locks and dam should be constructed 600 ft farther downstream than originally designed to increase the distance between the bend and the lock approach; (b) ports will be required in the upper guard wall to reduce or eliminate the intensity of crosscurrents at the end of the wall; (c) a large eddy will form in the lower approach, but the intensity of the currents in the eddy should not be sufficient to seriously affect the movement of tows ap-proaching the lock; and (d) dredging will be required along the left bank below the dam to eliminate the excessive contraction and backwater effects produced by an underwater prominence and to improve navigation conditions in the lower approach. (WES)

SPILLWAY, MILLERS FERRY LOCK AND DAM, ALABAMA RIVER, ALABAMA, Army Engineer Waterways Experiment Station, Vicksburg, Miss. G. A. Pickering.

Available from the National Technical Information Service as AD-717 979, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 3-643, Feb 64.63 p.

Descriptors: *Dams, *Model studies, *Spillways, Flow, Construction costs. Identifiers: Millers Ferry Lock and Dam (Ala), Alabama River.

The model of the gated spillway, constructed to an undistorted scale of 1:50, reproduced one 50-ft-wide gate bay and approximately half of each adjacent gate bay. The general purpose of the model study was to determine the flow characteristics over the spillway and to verify the adequacy of the stilling basin design. Tests revealed that flow separated from the downstream face of the original

gate sill and a parabolic shape was added in order to guide flow into the stilling basin. The spillway rating curves were determined with full and partial gate openings for both gate sill shapes. The stilling basin as originally designed functioned satisfactori-ly below the curved sill shape, but alterations were tested in an effort to reduce construction costs. The design; therefore, the original design is recommended. (WES)
W71-07788 altered basins were not as efficient as the original

DESIGNS FOR RUBBLE-MOUND BREAK-WATER REPAIR, KAHULUI HARBOR, MAUI, HAWAII,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. R. A. Jackson.

Available from the National Technical Information Service as AD-717 980, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-644, Feb 64.89 p.

Descriptors: *Breakwaters, *Model studies, *Harbors, Ocean waves, Concrete shore protection.
Identifiers: Protective coverings, Kahului Harbor,
Maui (Hawaii), Rubble mound breakwater.

Tests were conducted on 1:68.5-scale models of breakwater sections to obtain data from which economical and stable designs could be developed for repair of the damaged breakwaters at Kahului Harbor. Proposed designs involved protective cover layers of 35and 50-ton tribar armor units. Design of the breakwater repair was difficult because of the large prototype design wave (34 ft high), the limited space between the concrete monoliths on the crowns of the existing breakwaters and the limits of the navigation channel and harbor basin, and the limited lifting capacity and horizontal reach of available construction equipment at Kahului. Repair designs were developed, for both east and west breakwaters, that would withstand the attack of the selected 34-ft prototype design wave. It was also determined that repairing the damaged portion of the west breakwater head would not cause damage to the undamaged portion of the head and trunk. (WES) W71-07789

SPILLWAY FOR PROCTOR DAM, LEON RIVER, TEXAS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. E. S. Melsheimer, and T. E. Murphy

Available from the National Technical Information Service as AD-717 981, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-645, Mar 64, 44 p.

Descriptors: *Dams, *Model studies, *Spillways, Pressure, Texas, Weirs. Identifiers: Rivers, Procter Dam, Leone River.

The spillway will include a low weir with sloping upstream face and an ogee crest. The crest was designed for a head of 29 ft although heads up to 39 ft are expected. Tests were conducted in a 1:40scale section model of the spillway to verify the adequacy of the proposed crest shapes with the upstream face of the weir on slopes of 3 on 2 and 3 on 3. Optimum pressure conditions and discharge coefficients were obtained with a crest shape which was tangent to the upstream face of the dam. (WES) W71-07790

EFFECTS ON LAKE PONTCHARTRAIN, LA., OF HURRICANE SURGE CONTROL STRUC-TURES AND MISSISSIPPI RIVER-GULF OUT-LET CHANNEL, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

I. C. Tallant, and H. B. Simmons.

Available from the National Technical Information Service as AD-717 978, \$3.00 in paper copy, \$0.95

Group 8B—Hydraulics

in microfiche. WES Technical Report 2-636, Nov 63, 113 p.

Descriptors: *Breakwaters, *Model studies, Flood control, Surges, Hurricanes, Drainage, Shore protection, Tides, Lakes, Louisiana, Gulfs, Salinity, Barriers, Inland waterways.

Identifiers: Tropical cyclone, Damage, Inland waterways, Lake Pontchartrain, New Orleans (La).

A system of barriers along the south shore and across the eastern end of Lake Pontchartrain has been proposed as a plan for protecting New Orleans from hurricane damage. A model study was conducted to determine the effect of these barriers and also that of the Mississippi River-Gulf Outlet Channel (now under construction) on the hydraulic and salinity regimen of Lake Pontchartrain and adjoining lakes. It was concluded that: (a) freshwater inflow must be given equal consideration with any plan for modification of the salinity regimen of the lake system; (b) the proposed con-trol structures for Chef Menteur and Rigolets would have little adverse effect on salinities and tidal heights; (c) the connection of the Gulf Outlet Channel to Lake Pontchartrain will increase salinity in the lake such that a control structure will be required; (d) complete closure of all structures during a hurricane would not cause adverse salinity conditions or increase the high-water elevation by more than 1.4 ft msl; (e) operation of the Bonnet Carre Spillway at design flow with the Gulf Outlet Channel connected and hurricane structures installed in the passes would raise the high-water elevation to 1.4 ft msl. (WES) W71-07791

TYPICAL SPILLWAY STRUCTURE FOR CENTRAL AND SOUTHERN FLORIDA WATER-CONTROL PROJECT,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. L. Grace, Jr.

Available from the National Technical Information Service as AD-717 977, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-633, Sep 63, 69 n.

Descriptors: *Dams, *Model studies, *Flow, *Spillways, Drainage, Flood control, Florida.

A typical control structure, a low ogee spillway with vertical-lift gates, was studied on a 1:16-scale model to determine the effects on discharge characteristics of various approach and exit channel elevations under free and submerged, uncontrolled and controlled flows. Results indicated that the discharge characteristics for each type of flow can be satisfied by certain equations. The approach depth does not affect submerged-flow discharge coefficients, and approach depths greater than the design head do not appreciably affect free-flow coefficients. However, approach depths less than the design head do affect free-flow coefficients. Exit channel elevations affect uncontrolled flow more than controlled (almost no effect), and free more than submerged. There is a critical exit channel elevation at which the structure's efficiency in passing uncontrolled flows is greatly reduced. The test data do not permit a complete solution of the problem, but do afford a firmer basis for design. Additional model and field data are needed for a complete solution. (WES)

OUTLET WORKS, DEGRAY DAM, CADDO RIVER, ARKANSAS: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. R. Bucci.

Available from the National Technical Information Service as AD-718 683, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-684, Vicksburg, Miss, July 1965. 20 p, 21 photos, 32 plates. Descriptors: *Dams, *Model studies, *Sluice gates, Test procedures, *Outlets, Flow, Pressure, *Stilling basins.

Identifiers: Arkansas, Caddo River, Degray Dam.

The model investigation of the single-tunnel outlet works was concerned with developing a stilling basin suitable for high diversion flows (up to 28,000 cfs) and high-energy flood-control releases (up to 6000 cfs). The 1:23-scale model reproduced the intake tower, tunnel, stilling basin, and exit channel. Both a slide-gate and a cylinder-gate intake tower were tested. The cylinder-gate tower operated with a lower head loss and with less tendency to cause surging than did the slide-gate tower. A stilling basin requiring minimum excavation and providing satisfactory energy dissipation of both diversion and flood-control releases was developed. (WES) W71-07793

SPILLWAY FOR AMISTAD DAM, RIO GRANDE, MEXICO AND UNITED STATES. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. L. Grace, Jr.

Available from the National Technical Information Service as AD-718 223, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-653, Aug 64.98 p.

Descriptors: *Dams, *Model studies, Concrete, Soils, Foundations, Spillways, Stilling basins, Abutments, Walls, Drainage, Hydrostatic pressure. Identifiers: Altitude, Amistad Dam, Rio Grande River, Weirs.

This report presents the results of tests conducted on a 1:70-scale section model reproducing one-half of the spillway for Amistad Dam, a combination concrete gravity and earth embankment structure rising 253 ft above the bed of the Rio Grande. The spillway consists of an ogee crest controlled by 16 tainter gates, 50 ft wide and 54 ft high, and a hydraulic jump type stilling basin. The spillway will be flanked on each side by a powerhouse. Discharge characteristics of the spillway, hydrostatic pressures on the ogee weir crest, lateral pressures on the gate piers, performace of both singleand double-stage stilling basins at various elevations, and the height and length of both spray and stilling basin training walls were investigated. theoretical spillway rating curve and the expected hydrostatic pressures on the weir crest were in close agreement with those determined with the model. Stilling basin performance of the original design was found to be unsatisfactory. However, satisfactory stilling basin designs were developed for three apron elevations. The height of the original spray wall was found to be inadequate due to the effect of the abutment on the water-surface profile. The original height and length of the stilling basin training walls were found to be the optimum. (WES)

W71-07794

SELECTION OF OPTIMUM PLAN FOR REDUCTION OF WAVE ACTION IN MARINA DEL REY, VENICE, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

C. W. Brasfeild.

Available from the National Technical Information Service as AD-718 684, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-671, Vicksburg, Miss, Jan 1965. 21 p, 6 tab, 20 photos, 16 plates.

Descriptors: *Breakwaters, *Model studies, Ocean waves, Tides, California, Test procedures. Identifiers: Ocean models, Marina del Rey, Venice (Calif).

A 1:75-scale model, molded in concrete, was used to develop an optimum plan of improvement for

reducing wave heights to a satisfactory level within the harbor of Marina del Rey. The marina consists of a 2-mile-long channel and eight lateral basins. The model reproduced the entire harbor and enough of adjacent Santa Monica Bay to allow propagation of the required test waves. A 40-ft-long wave machine and electrical-wave-height measuring and recording apparatus were utilized in model operation. It was concluded from test results that a 2325-ft-long, wing-type, offshore rubble-mound breakwater in front of the harbor entrance offered greater protection to the entire harbor area than any of the other plans tested. Although other plans were developed which furnished adequate protection to the individual basins, they were not as efficient as the breakwater in reducing water heights in the harbor entrance and main channel. (WES)

FILLING AND EMPTYING SYSTEM, JONESVILLE LOCK, QUACHITA-BLACK RIVERS, LOUISIANA: HYDRAULIC MODEL INVESTIGATION.

INVESTIGATION,
Army Engineer Waterways Experiment Station,
Vicksburg, Miss.

N. R. Oswalt, J. H. Ables, Jr., M. B. Boyd, and T. E. Murphy.

Available from the National Technical Information Service as AD-718 681, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-678, Vicksburg, Miss, June 1965. 25 p, 16 tabs, 36 plates.

Descriptors: *Dams, *Model studies, *Locks, *Flow control, Vortices, Louisiana, River flow, Intakes, Outlets.

Identifiers: Water entry, Black River, Quachita River.

The filling and emptying system of the 600- by 84-ft Jonesville Lock will consist of wall intake manifolds, a 10- by 10-ft longitudinal culvert in each wall, reverse-mounted tainter valves, sidewall ports, and sidewall outlet manifolds. Normal operating heads will range from 15 to 30 ft. The hydraulic system was tested in a 1:25-scale model which simulated all essential features of the prototype. The original design intake and outlet manifolds performed satisfactorily. Tests of 31 sidewall port arrangements resulted in the adoption of 17 ports per culvert spaced 20 ft on centers with 8- by 8- by 2-ft-deep recesses in the lock chamber floor in front of each port. With the adopted hydraulic system installed in the model, hawser stresses on 4- and 6-barge tows were well within the 5-ton limit during operation at normal. (WES)

SPILLWAY MODIFICATIONS, MIRAFLORES DAM, PANAMA CANAL ZONE: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

T. E. Murphy, and R. S. Cummins, Jr.

Available from the National Technical Information Service as AD-718 801, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-667, Vicksburg, Miss, Jan 1965. 13 p, 16 plates.

Descriptors: *Dams, *Model studies, *Erosion, *Spillways, Stilling basins construction materials, Flow.

Identifiers: Panama, Fluid flow, *Miraflores dam.

Miraflores Dam spillway is a gravity ogee section designed for a maximum head on the crest of 18 ft. The spillway is composed of eight 45-ft-wide bays with vertical-lift gates. The spillway crest is at elevation 38.67 and the downstream face of the spillway is terminated by a 38-ft radius which brings the toe tangent to a horizontal plane at elevation -15. No stilling basin is provided. Since the spillway was put in operation in 1917 a maximum flow of 25,290 cfs has been experienced. This flow is about one-fourth of the spillway design flood. Erosion of the rock downstream from the toe

of the spillway has progressed until the dam is in danger of partial failure. Model investigations on a 1:36-scale general model and 1:20- and 1:50-scale section models were made to determine the suitability of various schemes. (WES)
W71-07798

SPILLWAY FOR STOCKTON DAM, SAC RIVER, MISSOURI: HYDRAULIC MODEL IN-VESTIGATION,
Army Engineer Waterways Experiment Station,
Vicksburg, Miss.
E. S. Melsheimer.

Available from the National Technical Information Service as AD-718 682, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-683, Vicksburg, Miss, July 1965. 15 p, 20 plates.

Descriptors: *Dams, *Model studies, Flow control, *Spillways, Walls, Missouri, Flow, Stilling basins. Identifiers: Sac River, Stockton Dam.

A 1:60-scale comprehensive model and a 1:100scale section model were used to determine flow conditions in the approach channel and the performance of various elements of the Stockton Dam structure. The overall performance of the original design structure was satisfactory. Flow conditions in the approach, at the abutments, over the spillway, and on the chute were satisfactory. The capacity of the spillway as determined on the model was greater than the computed. The performance of the original design stilling basin was satisfactory in the dissipation of all spillway discharges. However, three alternate designs were investigated in an attempt to effect economies in construction costs. A stilling basin was developed which permitted a reduction in the size of basin elements and permitted the basin elevation to be raised 5 ft. The model tests also indicated that the height of the stilling basin divider wall could be reduced 5 ft without affecting the efficiency of the basin. (WES)

WAVE ACTION AND BREAKWATER LOCATION, HALF MOON BAY HARBOR, HALF MOON BAY, CALIFORNIA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

H. B. Wilson.

Available from the National Technical Information Service as AD-718 224, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 2-655, Vicksburg, Miss, Oct 1965. 8 p, 24 photos, 23 plates

Descriptors: *Breakwaters, *Gates, Ocean waves, Model studies, Test procedures, California. Identifiers: Deep water, Design, Ocean models, Half Moon Bay (Calif).

Tests were conducted to investigate (1) flow conditions and maximum bottom velocities downstream of a trapezoidal gate sill without stilling basin; (2) the relative merits of a parabolic gate sill with a roller bucket energy dissipator and a parabolic gate sill with a stilling basin consisting of a horizontal apron terminated by a sloping end sill; and (3) the stability of a horizontal protective stone blanket downstream of the most practical energy dissipator. The trapezoidal gate sill permitted separation of the nappe from gate sill and an undesirable flow condition termed an undulating jet which created high bottom velocities and objectionable surface waves in the exit channel. Therefore, the use of such a sill and the possibility of eliminating stilling basins at certain low-head dams on the Arkansas River were eliminated from further consideration. (WES) W71-07800

SPILLWAY AND SLUICES, ALLEGHENY DAM, ALLEGHENY RIVER, PENNSYLVANIA AND NEW YORK. HYDRAULIC MODEL IN-VESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. R. Bucci, and T. E. Murphy.

Available from the National Technical Information Service as AD-717 972, \$3.00 in paper copy, \$0.95 in microfiche. Technical report 2-621, Mar 63. 109

Descriptors: *Dams, *Model studies, *Fluid flow, *Spillways, *Stilling basins, Sluices, Energy dissipation, Pennsylvania.

Identifiers: Drainage, Allegheny Dam, Allegheny River, Stilling basins, Baffle piers

Investigation of the spillway and sluices on a 1:36scale model involved verification of hydraulic performance of the spillway, refinement of the stilling basin design, and selection of high-level and lowlevel sluice designs. Tests indicated that the maximum expected discharge (140,000 cfs) was satisfactorily passed by the spillway and the six lowlevel sluices at a head on the spillway crest of 29 ft. A high-level sluice, discharging through the spillway spray walls, with its major axis parallel to the spillway slope, effectively spread flow across the spillway weir. A horizontal low-level sluice with flared exit and tetrahedral deflector provided good flow distribution in the basin. The stilling basin effected satisfactory energy dissipation with the apron raised 3 ft and the baffle pier pier height decreased 3 ft. (WES) W71-07801

FLOW CHARACTERISTICS IN FLOOD-CON-TROL TUNNEL 10, FORT RANDALL DAM, RIVER, SOUTH DAKOTA. HYDRAULIC PROTOTYPE TESTS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. V. Dawsey, Jr., C. J. Huval, and W. C. Blanton.

Available from the National Technical Information Service as AD-717 974, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-626, June 1963. 84 p.

Descriptors: *Dams, *Fluid flow, *Flood control, *Underground structures, Model studies, Tunnels, Missouri River, Anemometers, Flow meters, Data processing

Identifiers: Transducers, Four Randall Dam, Data reduction, Flood control tunnels.

Tests were conducted in tunnel 10 to investigate flow characteristics of a large circular tunnel, flowing full. Measurements included pressures in the tunnel intake and along the tunnel, and velocity distributions obtained from nine total-head tubes mounted on a streamlined strut spanning the tunnel horizontally. The strut instrumentation also included six pressure transducers and three hot-film anemometers. The electrical signals from the transducers and anemometers were recorded on both oscillographs and magnetic tape. Total-head tubes mounted on boundary zone probes were used to traverse the region of flow near the wall. Intake and transition pressures were generally lower than those measured in a previous model study of the tunnel. Resistance coefficients indicate an interior surface intermediate between hydraulically smooth and rough. (WES) W71-07802

DETACHED BREAKWATER AND IMPROVED NAVIGATION ENTRANCE LORAINE HAR-BOR, LORAIN, OHIO. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

H. B. Wilson, R. Y. Hudson, and J. G. Housley Available from the National Technical Information Service as AD-717 975, \$3.00 in paper copy, \$0.95 in microfiche. Technical report 2-628, June 1963.

Descriptors: *Breakwaters, *Navigation, *Harbors, *Waves (Water), Flowmeters, Storms, Currents (Water), Velocity, Model studies. Identifiers: Water traffic, Lorain Harbor, Lorain

A 1:125-scale model of the harbor and adjacent areas, equipped with wave-generating and -measur-ing devices, was used to determine the optimum length and alignment of a proposed detached breakwater lakeward of the existing breakwater system, and the optimum shape and width of navigation opening to protect the harbor entrance and mooring area from storm waves and currents, and to improve navigation conditions for large vessels. Five of the ten plans tested met the waveheight and current-velocity criteria. The recommended plan of these five, based on economy of construction, provides for a 2250-ft-long detached breakwater and the removal of 300 ft of the existing east breakwater. (WES)
W71-07803

NAVIGATION AND SEDIMENTATION CONDITIONS AT TYPICAL LOCK AND DAM, ARKANSAS RIVER, ARKANSAS AND OKLAHOMA.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. J. Franco, and C. D. McKellar, Jr.

Available from the National Technical Information

Service as AD-717 973, \$3.00 in paper copy, \$0.95 in microfiche. Technical report 2-623, Apr 1963.

Descriptors: *Dams, *Sedimentation, *Navigation, Inland waterways, Rivers, Oklahoma, Arkansas, Shoals, Mississippi River. Identifiers: Site selection, Water traffic, Arkansas

River, Moveable-bed model.

As part of the studies for development of a navigable waterway from the Mississippi River to the general area of Tulsa, Oklahoma, a movable-bed, distorted scale model of a typical 5-mile reach of the Arkansas River was used to study problems involved in the location, design, and operation of a lock and dam on an Arkansas River bend. Principal conclusions were: (1) The lock and dam should be placed as far downstream of the point of the convex bar as possible to minimize crosscurrents and scouring in the upper approach. (2) Ports will be required in the upper guard wall of the lock to reduce the intensity of the crosscurrents near the end of the guard wall. (3) Shoaling in the lower lock approach, which would tend to be heavy, could be reduced by a wing wall at the end of the lower guard wall. (4) There is no appreciable difference between a stepped-sill and a level-sill dam insofar as the movement of sediment is concerned. (WES) W71-07804

SPILLWAY AND SLUICES, RED ROCK DAM, DES MOINES RIVER, IOWA: HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. R. Bucci, and T. E. Murphy.

Available from the National Technical Information Service as AD-718 680, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-673, Mar 1965. 98 p.

Descriptors: *Dams, *Model studies, *Spillways, *Sluice gates, Iowa, Cavitation, Test procedures, River flow, Pressure.

Identifiers: Des Moines River, Red Rock Dam.

The spillway and sluices of Red Rock Dam were studied on a general model of the spillway and on a section model of the sluice outlet. Particular emphasis was given determination of the maximum elevation of the stilling basin apron and minimum height of the training walls. Studies were also conducted to determine pressure conditions at the sluice outlet portals and the effect of spillway flow on

Field 08—ENGINEERING WORKS

Group 8B-Hydraulics

the capacity of the sluices. The combined capacity of the spillway and sluices was less than computed because of losses at the spillway abutments and the effect of the spillway nappe on the sluice flow. The recommended stilling basin utilized a 206.48-ft-long apron at elevation 654 surmounted by two rows of 12-ft-high baffle piers and a 10-ft-high end sill. The training walls performed satisfactorily with their tops at elevation 715. This basin barely maintained the hydraulic jump at the spillway design flood. The sluice outlet model tests indicated that cavitation will not occur at the sluice outlet portal under the proposed method of combined spillwaysluice operation. As a check on this conclusion, the Folsome Dam high-level sluice was reproduced in this model. (WES) W71-07805

STABILITY OF SOUTH JETTY SIUSLAW RIVER, OREGON, HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss. R. A. Jackson.

Available from the National Technical Information Service as AD-717 976, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical report 2-631, July 1963.58 p.

Descriptors: *Jetties, *Rock fills, *Sea walls, *Model studies, *Harbors, Rock properties, River training, Water waves, Stability, Rehabilitation.

Tests were conducted on 1:50-scale models of jetty sections to obtain design criteria for rehabilitation of the south jetty at the mouth of the Siuslaw River, and for similar jetties at the entrances to rivers along the Washington and Oregon coasts. The tests were also concerned with evaluating a special method of stone placement, developed by the Portland District. It was concluded from the investigation that: (1) one layer of quarrystones placed on the crown and on side slopes of 1:1.5 would be suitable for the repair of jetties situated in water depths less than about 16 ft, and design-wave heights not greater than 13 ft; (2) two layers of quarrystones on side slopes of 1:2 from crown to low-tide elevation would be suitable for the repair of jetties situated in water depths greater than 16 ft, and for design-wave heights as large as 17 ft; (3) at the jetty head, two layers of quarrystones at the junction of the head and trunk to four layers along the line of the jetty shoulder are needed for adequate protection; and (4) the special Portland District method of placement slightly improves the stability of the quarrystone cover layers compared with other random placement methods. (WES) W71-07806

AN EVALUATION OF OKRA GUM AS A DRAG REDUCING ADDITIVE IN PIPE FLOW,

Clemson Univ, S.C. Dept. of Engineering

Joseph George Neuwirth, Jr.

M.S. Thesis, Clemson University, Aug 1970. 71 p, 19 fig, 19 ref, append. OWRR Project A-009-SC

Descriptors: *Friction, *Fluid friction, Flow, *Pipes, Hydraulics, Viscosity, *Lubricants. Identifiers: Friction reduction, *Okra gum, Guor gum, Polyethylene oxide.

The specific purpose was to study the relation of additives to the phenomenon of drag reduction by constructing and instrumenting suitable flow systems that would perform within both the laminae and turbulent flow regimes. Okra gum in aqueous solution is a very effective drag reducing additive. Friction reduction was not related to any property changes since viscometric measurements showed apparently Newtonian behavior for con-centrations as high as 250 weight parts per million (WPPM). Solutions with okra gum displayed superior friction reducing characteristics for low Reynolds number flows with an optimum effect

resulting from a concentration of 25 WPPM as compared to 50 WPPM with polyethylene oxide. Although there was no indicated drag reduction onset point for the okra gum, its behavior indicated that its viscoelastic properties and molecular struc-ture were comparable to that of guar gum and polyethylene oxide. W71-07837

URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD (DISCUSSION), For primary bibliographic entry see Field 04C

URBAN RUNOFF BY ROAD RESEARCH LABORATORY METHOD (DISCUSSION), For primary bibliographic entry see Field 04C W71-07844

COMPUTER CONTROL OF REAL-TIME URBAN RUNOFF, (DISCUSSION), George Fleming, and Robert L. McFall.

J Hydraulics Div, Am Soc Civil Engrs, Vol 96, No HY9, p 1908-1909, Sept 1970.

Descriptors: *Runoff, *Hydraulics, *Mathematical models, *Digital computers, Water management (Applied).

Fleming: A method to calculate continuous runoff volumes preferred by the writer is to employ simulation techniques using the Hydrocomp Simulation Program which simulates the complete land phase of the hydrological cycle, and uses kinematic wave assumptions for flow in circular conduits. For purposes of the mathematical model a large scale computer could be assessed using the PDP-9 for data acquisition and control of automatic gates. McFall: The writer would like to see a breakdown of costs into the categories of (1) capital outlay, (2) equipment operating, and (3) personnel cost. (See also W70-05882) W71-07845

STORM SEWER DESIGN,

For primary bibliographic entry see Field 05G. W71-07864

ANALYSIS OF SLOT ORIFICE FISHWAYS,

Idaho Univ., Moscow. For primary bibliographic entry see Field 081. W71-08045

RELATIONSHIP BETWEEN THE RATE OF SHORE DEFORMATION AND FLOW VELOCITY (RUSSIAN: ZAVISIMOST' INTENSIVNOSTI BEREGOVYKH DEFORMATSIY OT

SKOROSTI POTOKA), Moscow State Univ., (USSR). N. A. Milhaylova, and O. B. Shevchenko. Meteorologiya i Gidrologiya, No 12, p 80-83, Dec 1970. 4 p, 2 fig, 5 ref.

Descriptors: *Deformation, *Shore protection, *Beach erosion, *Flow rates, *Sediment transport, Channels, Flumes, Channel morphology, Channel erosion, Dikes, Bottom sediments. Identifiers: *USSR, Flow velocity, Channel defor-

mations, Bottom erosion.

A deformation rate defined as the ratio of the change in the value of a certain channel characteristic to time is used to describe the interaction of flow and a deformable bottom, and the interaction of flow and erosible shores. Data on the rate of shore deformations and flow velocity for an entire channel width suggest that flow velocity is one of the principal factors determining the rate of shore deformations. Characteristics of depth deformations and the discharge and transport rate of a stream are determined by average depth of velocity, velocity at a distance of several particle diameters, and velocity at a distance of one-eighth

of the width of the channel from the shore. The or the width of the channel from the shore. The graph derived shows a sharp decrease in the rate of deformations as a result of shore protection by tetrahedrons and pile dikes. Laboratory studies were conducted in a channel flume 23 m long, 4 m wide and 1 m high, using Lyubertsy sand 0.25 mm in size. (Josefson-USGS)

TRANSFORMATIONS OF BREAKING WAVE CHARACTERISTICS OVER A SUBMARINE

Michigan State Univ., East Lansing. Dept. of

Michigan State Only, East Editing Geology.
William L. Wood, Jr.
Available from the National Technical Information Service as AD-718 904, \$3.00 in paper copy, \$0.95 in microfiche. Dept. of Geology Technical Report No 4, Dec 1970. 116 p. ONR 388-089.

Descriptors: *Beaches, *Ocean waves, *Lakes, *Beach erosion, Lake Michigan, Lake beds. Identifiers: *Lake waves, Wave functions, Ocean bottom, Great Lakes, Submarine bars.

The effect of a submarine bar on the transformation of breaking wave characteristics is to create a filter on wave celerity and length. The degree of fil-tering is directly related to the intensity of wave breaking. The filtering effect of the submarine bar suggests that this is the reason for better agreement between observed wave parameters and theory in the reforming zone shoreward of the submarine The role of turbulence of flow induced by breaking is the most important factor in wave height attenuation shoreward of the submarine bar. As a result theoretical expressions for shallow water wave transformations in the nearshore zone must take turbulent dissipation into consideration as a major factor.
W71-08169

DESIGN CONDUIT SYSTEM BY DYNAMIC PROGRAMMING,

Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.

Tung Liang. Journal of the Hydraulics Division, ASCE, Vol 97, No HY 3, p 383-393, Mar 1971. 11 p, 4 fig, 17 ref, 2 append.

Descriptors: *Dynamic programming, *Optimization, *Systems analysis, *Distribution systems, *Design, *Digital computers, Conduits, Pipelines, Costs, Constraints, Pressure, Water transfer.

A method based on dynamic programming and systems analysis wasdeveloped for optimizing a fluid distribution system. For the purpose of testing the dynamic programming technique in analyzing the tremendous number of system alternatives and in optimizing system design, a simple water transport system (serial type) was first considered consisting of N pipe segments with known characteristics jointed in a straight line. The designer's responsibility was to evaluate all possible alternatives and select the most economical design. The method included measurement of the system effectiveness, consideration of transformations and constraints, and the use of dynamic programming in order to decompose the problem so decisions can proceed one or two at a time with the use of a digital computer. Stagewise optimization was achieved and the problem was converted from a multiple decision single-stage problem into a multi-ple stage single-decision problem. The optimization logic was outlined in a flow chart and an example where the design engineer must minimize annual where the design engineer must minimize annual cost for a 200-ft, pipeline was described and solved. It was observed that input pressure and pipe configuration have a considerable influence on the cost of transporting fluid. (Kriss-Cornell)

INTRODUCTION TO BAYESIAN METHODS USING THE THOMAS-FIERING MODEL. Kansas City Univ., Manhattan.

For primary bibliographic entry see Field 06A. W71-08194

THE USE OF RIVER MODELS IN POWER PLANT HEAT EFFECT STUDIES,

Worcester Polytechnic Inst., Mass. Alden Research

For primary bibliographic entry see Field 05B. W71-08315

STRATIFICATION OF FLOW FROM CHANNEL INTO DEEP LAKE, (DISCUSSION),

New South Wales Univ., Kensington (Australia). Water Research Lab.

Journal of the Hydraulics Division, Transaction of American Society of Civil Engineers, Vol 97, No HY4, p 602-609, Apr 1971.

Descriptors: *Heated water, *Thermal stratifica-tion, *Cooling, *Hydraulic jump, *Heat transfer, *Energy equation, Continuity equation, Lakes, Thermal pollution.

Identifiers: *Entraining jumps, *Skimmer gate.

The writer of the discussion describes his own investigation into one aspect of flows which may result when heated water is discharged from a channel into a reservoir containing cooler water, namely, where the discharge from the channel outfall is internally supercirtical. An analysis of an entraining jump controlled by a skimmer gate is presented. The author's classification of two layer stratified flows is extended by the writer, who considers the effect of entrainment in the transition zone on the characteristics of the layer downstream. Three equations are used for this purpose: (1) continuity of density difference in the section comprising entraining and roller zones; (2) equilibrium of the horizontal momentum flux and pressure force per unit width upstream and downstream of the jumps; and (3) energy conserva-tion downstream. The writer concludes that when considering maximum efficiency of cooling ponds as heat dissipators, the problem of designing the cooling water outfall becomes that of maintaining a flooded internal jump at the outfall. (Oleszkiewicz-W71-08321

8C. Hydraulic Machinery

PRACTICAL PROBLEMS IN COMBINING ELECTRIC POWER PRODUCTION WITH SEA WATER DESALINATION,

San Diego Gas and Electric Co., Calif.

Jon P. Hardway.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$0.45. Office of Saline Water Research and Development Progress Report No 607, Dec 1970, 34 p, 8 fig. OSW Contract 14-01-0001-1142

Descriptors: *Desalination, *Saline water conversion, *Flash distillation, *Electric power, *Power plants, Power systems operations, Maintenance and operation, Desalination equipment.

Identifiers: Desalination plant operations, Power plant operations.

This document contains a general discussion concerning the management, operation, and information gained in combining a commercial electric utility power plant with desalination plants. The power plant is providing electric power and steam (both directly from the boilers and through turbine extraction) to the desalting plants. The desalting plants consist of a 1,000,000 gallon per day multi effect, multi stage, high performance plant and a 2,500,000 gallon per day plant. The power plant is a 167 mega watt steam cycle, fuel fired, compound double flow turbine unit of the San Diego Gas and Electric Company. (Lohman-Office of Saline Water) W71-07833

SHORT TERM PROSPECTS FOR IMPROVING EFFICIENCY OF POWER PLANTS,

Massachusetts Inst. of Tech., Cambridge Herbert H. Woodson.

In: Electric Power and Thermal Discharges; Thermal Considerations in the Production of Electric Power, Gordon and Breach, New York, p 269-279,

Descriptors: *Thermal pollution, *Thermal powerplants, *Nuclear powerplants, *Efficiencies, *Cooling, *Cooling water.

Identifiers: *Fossil-fueled powerplants, *Combustion gas turbines, Reactors, Gas-cooled reactors, Breeder reactors

For fossil-fueled plants, it appears that short term improvements in efficiency will most likely come from combined cycles using combustion gas turbines as topping units with steam cycles. Another technically possible concept for improved efficiency is the binary vapor cycle but much development work would have to be done on it. Light-water, nuclear-fueled plants will have small evolutionary increases in efficiency over the short term. Significantly higher efficiency in nuclear plants could result from widespread use of the high-temperature, gas-cooled reactor. Advanced breeder reactors with significantly higher efficiencies have a chance of making a commercial appearance over the short term. (See also W71-08298) (Olesz-kiewicz-Vanderbilt) W71-08311

8D. Soil Mechanics

SEISMIC ACTIVITY IN THE VICINITY OF SAN LUIS RESERVOIR.

Bureau of Reclamation, Denver, Colo. Engineering

and Research Center. George C. Rouse.

Available from the National Technical Information Service as PB-197 327, \$3.00 in paper copy, \$0.95 in microfiche. Report REC-OCE-70-52, Nov 1970. 7 p, 5 fig, 2 tab, 4 ref.

Identifiers: Earth dams. Seismic Earthquake engineering, Seismology, Seismic investigatations, Earthquakes, California, Central Valley Project, Faults geology, Seismic waves, Reservoir design, Reservoir sites, Seismographs, San Luis Reservoir (Calif), San Luis Dam (Calif), San Andreas Fault (Calif), Ortigalita Fault (Calif).

For many years, engineers have been concerned that loads produced by large reservoirs on the earth's crust could cause earthquakes. This problem was first investigated during the initial filling of Lake Mead by making seismic recordings at 3 locations near this lake. Data obtained from these recordings indicated that crustal loadings produced by the reservoir did not cause an increase in local earthquakes. A similar study was made during the filling of San Luis Reservoir, a 2,100,000acre-ft body of water located near Los Banos, Calif. The reservoir is in an area which has been subjected to intense activity. A portion of the Ortigalita Fault extends beneath the lake area, and the San Andreas Fault passes within 22 mi of this location. Data obtained during the San Luis seismic investigation also furnish little or no indication that reservoir loadings on the earth's crust cause an increase in local earthquakes. W71-08170

ERODIBILITY OF SLOPES (PHASE I),

California State Div. of Highways. Materials and Research Dept. For primary bibliographic entry see Field 02J. W71-08171

8F. Concrete

INVESTIGATION NONMETALLIC OF WATERSTOPS, REPORT 5. RETENTIVITY OF LABYRINTH-SHAPED WATERSTOPS, Army Engineer Waterways Experiment Station,

Vicksburg, Miss. Billy J. Houston.

Available from the National Technical Information Service as AD-718 226, \$3.00 in paper copy, \$0.95 in microfiche. WES Technical Report 6-546, Vicksburg, Miss, Jan 1971. 10 p, 2 tab, 6 photos.

Descriptors: *Sealants, *Environmental effects, *Leakage, Water pressure, Hydraulic systems, Concrete, Rubber, Plastics, Failure (Mechanics), Joints (Connections), Degradation, Weathering. Identifiers: Polyvinyl chloride, Shear stresses, Separation, Synthetic rubber, Labrinth shaped waterstops, Water retention.

This is the fifth report in the Investigation of Nonmetallic Waterstops series, and presents the results of tests conducted to evaluate the water-retaining properties of labyrinth-shaped waterstops of two shapes. The advantage of labyrinth waterstops over waterstops of conventional shape is that the use of labyrinth waterstops does not require splitting and bracing of concrete forms so that the waterstop can protrude from one placement into the area where the next placement will come. Since the Corps of Engineers is now allowing the use of labyrinth waterstops under certain conditions where little or no differential joint movement is expected, there was a need to know how well labyrinth waterstops inhibit the passage of water through a joint. Report 4 of the series included the results of water-retentivity tests of conventional waterstops of four shapes, and the results of the tests of the labyrinth waterstops reported herein are compared with those results obtained earlier. The results of the tests and comparisons indicate that labyrinth waterstops are as effective in retaining water as conventionally shaped waterstops when there is no joint separation. Tests reported herein indicated that a joint separation of 1/4 in. seriously reduces the water-retaining properties of labyrinth waterstops, but an opening of 1/8 in. can be tolerated when hydraulic pressure behind the waterstop is below 100 psi. Apparently, failure of the seal when a joint is open even a small amount and hydraulic pressure is applied is caused by the pressure acting perpendicular to the concrete ridges within the waterstop, causing the concrete to fail in flexure. (WES) W71-07795

GUNITE GIVES NEW LIFE . . . TO AN OLD, FALLING BRICK SEWER SYSTEM. William M. Englerth.

Am City, Vol 85, No 7, p 101-102, Jul 1970.

Descriptors: *Sewers, *Construction, *Gunite, Repairing, Costs, Tennessee, Concretes, Linings. Identifiers: *Chattanooga (Tenn), Sewer lining, Capacity.

A visual inspection of the brick sewer system in Chattanooga, Tennessee resulted in its rehabilitation with pneumatically applied reinforced concrete lining, known as gunite. This repair method reduces the carrying capacity; however, the newly lined surface reduces many existing friction losses in the deteriorating conduit, and capacity in the repaired sewer is increased from the higher flow velocities. A total of \$633,113.70 was needed to repair the main brick sewers in the downtown area of Chattanooga. W71-07858

Group 8G—Materials

8G. Materials

INVESTIGATION OF NONMETALLIC WATERSTOPS, REPORT 5. RETENTIVITY OF LABYRINTH-SHAPED WATERSTOPS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08F.

W71-07795

SEAWATER CORROSION TEST PROGRAM

SECOND REPORT,
Dow Chemical Co., Freeport, Tex.
H. C. Behrens, C. F. Schrieber, O. Osborn, L. Rice, and B. P. Webb.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$1.25. Office of Saline Water Research and Development Progress Report No 623, Dec 1970. 113 p, 48 fig, 9 tab, 11 ref, 2 append. OSW Contract 14-01-0001-2150.

Descriptors: *Corrosion, *Desalination, Deacration, *Steel, *Aluminum, Aluminum alloys, Stainless steel, *Alloys, *Temperature, Dissolved oxygen, Carbon dioxide, Sea water, Saline water, Metals.

Identifiers: Mild steel, Low alloy steel, Corrosion

Hot seawater performance was considered for a mild steel, a high-strength, low alloy steel, three experimental low alloy steels, four stainless steel wrought and cast alloys, seven aluminum alloys, and one Alclad composition. Variables of dissolved oxygen, temperature, velocity, pH, and refresh-ment rate of seawater were considered. Low alloy steel corrosion rates were 30 percent less than mild steel for the same oxygen concentration. This advantage was pronounced through 300-ppb oxygen concentration levels. Mild steel was sensitive temperatures above 225F; less sensitive below. Optimum conditions for aluminum alloys in hot seawater is acidic pH at 50 to 100 ppb oxygen. Aluminum is possibly independent of oxygen after preconditioning. Alloys 3003 and 5454 showed highest level of performance. Alclad alloy 7072 self corrosion rate too high for satisfactory service life. (Filban-Office of Saline Water)

INVESTIGATION OF GALVANICALLY IN-DUCED HYDRIDING OF TITANIUM IN SALINE SOLUTIONS,

Battelle Memorial Inst., Richland, Washington. Pacific Northwest Labs.

L. A. Charlot.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$0.50. Office of Saline Water Research and Development Progress Report No 624, Dec 1970, 40 p. 11 fig. 8 tab, 18 ref, append.

Descriptors: *Corrosion, *Desalination, *Titanium, *Temperature, *Hydrogenation, Metals, Alloys, Inorganic compounds, *Steel, Stainless steel. Identifiers: Titanium-Hydride, Galvanic-Couples, Nickel alloy.

Galvanically induced hydriding of commercially pure titanium and titanium-2 nickel alloy was determined in 3.4 wt percent NaCl air-sparged and argon-sparged solutions at 140, 265, and 390F. Hydrogen charging of the titanium via couple assemblies of titanium to aluminum, titanium to mild steel, titanium to copper, titanium to nickel, and titanium to stainless steel was measured by high temperature vacuum extraction analysis of the exposed titanium metal. The presence of hydrogen in the titanium was verified by metallographic analysis, which also showed the distribution of hydrogen in the metal. Assessment of corrosion, apart from hydriding, of both members of the galvanic couple was made by weight change determinations and visual inspection. Galvanic couples were withdrawn from the test after 14, 42, 72, and 146 days at temperature and destructively analyzed to yield the required data. A corrosion performance ranking from least to most corrosion resistant for the metals coupled with titanium in the 140F argon-sparged test (least aggressive) is Al AA Mild Steel A Cu - Ni - Stainless Steel. In the 390F airsparged test (the most aggressive), the extent of corrosion of the dissimilar metals necessitated removal of aluminum and mild steel from the test after 14 days at temperature and removal of all samples after 72 days exposure. A relative ranking for this test is Al AA Mild Steel AA Cu — Stainless Steel A Ni. (Filban-Office of Saline Water)

DEVELOPMENT OF A CALIBRATION MODULE FOR TRACE OXYGEN ANALYZERS, CALIBRATION

Aerojet-General Corp., El Monte, Calif. H. C. Edgington, and R. M. Roberts.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402, Price \$1.25. Office of Saline Water, 20402, Frice \$1.25. Office of Sainte Water, Research and Development Progress Report No 625, Dec 1970, 140 p, 17 fig, 27 tab, 7 ref, 2 append. OSW Contract 14-01-0001-2127.

Descriptors: *Desalination, *Dissolved oxygen analyzers, *Volumetric analysis, Oxygen, Oxygenation, Dissolved oxygen, Analytical techniques. Identifiers: Winkler Method.

The design, fabrication, and testing of a Dissolved Oxygen Calibrator is described. The calibration module achieves deoxygenation in a two-stage spinning-disc stripper by flowing feedwater and oxygen-free nitrogen gas countercurrently. Oxygen is added by coulometric generation into the secondstage nitrogen purge gas. This instrument gives D. O. contents of 0 to 100 ppb which are accurate to within plus or minus 2 ppb. Inasmuch as existing methods for D. O. analysis were of undetermined accuracy, a parallel research was conducted which resulted in the development of an Aerojet-modified Winkler procedure. The novel features of this improved method include (1) sampling, fixing, and titrating under a nitrogen atmosphere, (2) treating the sample by a novel combination of single and double, normal and reverse mode of reagent additions to obtain data for the absolute determination of sample D. O. content, and (3) measuring and correcting for certain errors in the D. O. procedure. This has resulted in a procedure with demonstrable accuracy. The improved method has a precision and accuracy. The improved method has a precision and accuracy which is better than plus or minus 2 ppb. (Filban-Office of Saline Water) W71-07977

8H. Rapid Excavation

HEAT-ASSISTED TUNNEL BORING MACHINES,

United Aircraft Corp., East Hartford, Conn. Research Labs

Jeffrey P. Carstens, W. Richard Davison, Choate A. Brown, Frederick J. McGarry, and Alan R.

Available from the National Technical Information Service as PB-197 243, \$3.00 in paper copy, \$0.95 in microfiche. United Aircraft Research Laboratory Report No J-970802-12 and Federal Railroad Administration Report RT-71-63, Sept 1970. 328

Descriptors: *Rock excavation, *Drilling equipment, *Tunneling machines, Thermal properties. Identifiers: *Rock drilling, *Gas lasers, Heating equipment, Radiant heating, Cutting tools, *Heat weakening, *Heat assisted tunneling,

A study was performed to determine: (1) the increase in tunneling machine performance in hard rock resulting from heat weakening of the rock in advance of the tunneling machine, (2) the increase in hourly cost incurred by the heating system, and (3) the net effect of the increased performance and the increased hourly cost on the cost of the finished

tunnel. Rock-cutting experiments were performed on Barre granite using a 1-kw CO2-N2-He gas laser for rock heating and disc-type cutters of various diameters. Analytical work included the preparation of specific heat-assisted tunneler designs and their expected performance and economics. An alternative form of using heat for tunneling was also investigated in which slots were melted in the rock instead of merely heating it. The study concludes that the operation of tunneling machines incor-porating lasers to provide the heat weakening is technically feasible but economically unattractive. Radiant heaters have insufficient power density to effectively heat the rock, and high-temperature jets create serious environmental problems. However, the test program indicated that a more effective way to assist mechanical cutters would be to use concentrated thermal energy to melt shallow slots in the rock between cutter paths. W71-08168

81. Fisheries Engineering

CENTRARCHID FOOD HABITS IN A NEW AND OLD RESERVOIR DURING AND FOLLOWING BASS SPAWNING.

Bureau of Sport Fisheries and Wildlife, Fayetteville, Ark.

For primary bibliographic entry see Field 02H. W71-08035

ANALYSIS OF SLOT ORIFICE FISHWAYS,

Idaho Univ., Moscow.

M. S. Thesis, Idaho University Graduate School, Dec 1970. 101 p. 28 fig. 27 tab, append.

Descriptors: *Hydraulic design, *Fish passages, *Hydraulic models, Hydraulics, Design, Hydraulic engineering, Open channel flow, Silting, Flow, Discharge (Water), Velocity, Streamflow, Hydraulic structures, Weirs, Spillways. Identifiers: Rectangular-slot fishways.

Design criteria were developed for a slot orifice fishway. Sizing and spacing of slot orifices inside the fishway can be design to create flow conditions satisfactory for fish passage. The slot orifice fishway will function well in a wide range of discharges and should not have any serious silting problems. Values of drag coefficients for the slot orifice constrictions were evaluated by model studies for a range of slot openings varying from 0.6 to 0.85 of fishway width and culvert slope varying from horizontal to five percent. Nondimensional curves are given for the values of the drag coefficients of the slot orifice constrictions and also for the backwater relations for the slot orifices. An equation, based on momentum principle, enables the designer to find the rate of flow through the fish-Necessary criteria regarding suitability of flow for fish passage are also developed. (Knapp-USGS) W71-08045

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

WATER RESOURCES RESEARCH INVENTO-RY - 1969.

Department of National Development, Canberra (Australia).

Australian Water Resources Council, Water Research and Education Steering Committee Report, 1969, 212 p, 2 index.

Descriptors: *Projects, *Hydrology, *Water resources, *Foreign research, *Research facilities, Laboratories, Water resources development, Groundwater, Surface waters, Meteorology, Soil water, Sedimentation, Hydraulies, Urbanization, Identifiers: *Australia, *Water resources research.

Education (Extramural)—Group 9A

An inventory of research into water resources and directly related matters in Australia, with brief reference to earlier work is compiled from questionnaires circulated in mid-1968, and includes projects undertaken since 1964 or planned to commence during 1968/69. Each research project in mythoryd and prepared excillential. ject is numbered and arranged serially, with pro-jects from each institution grouped together as in-dicated in the Index of Research Institutions. Subdicated in the Index of Research Institutions. Subject index terms are allotted to each project. The titles of projects are inserted in the subject index against the index term so that a user may review all project titles associated with any given index term. Addresses of research institutions are given in the Index of Research Institutions. The Subject Index Terms are from the vocabulary of the Water Resources Thesaurus published by the Office of Water Resources Research, U.S. Department of the Interior, Washington, D.C., November 1966. (Knapp-USGS) W71-08093

10. SCIENTIFIC AND TECHNICAL INFORMATION

A SELECTED ANNOTATED BIBLIOGRAPHY OF ENVIRONMENTAL STUDIES OF IRAQ, JORDAN, LEBANON, AND SYRIA (1960 -

1969),
Environmental Technical Applications Center (Air Force), Washington, D.C.
For primary bibliographic entry see Field 02B.

PHOSPHORUS IN WATER AND WASTE WATER-AN ANNOTATED SELECTED BIBLIOGRAPHY,
North Carolina Univ., Chapel Hill. Waste water

Research Center.

For primary bibliographic entry see Field 05B. W71-07894

EARTH RESOURCES RESEARCH DATA FACILITY INDEX: VOLUME I, DOCUMENTA-RY DATA; VOLUME II, SENSOR DATA.

National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.

For primary bibliographic entry see Field 07C. W71-08046

CONSERVATION DIRECTORY 1971. National Wildlife Foundation. For primary bibliographic entry see Field 06E. W71-08236

REGIONAL INFORMATION DESIGN FOR PUBLIC DECISIONS, California Univ., Los Ángeles. For primary bibliographic entry see Field 06B. W71-08296



MORPHOLOGY AND ABLATION PROCESSES ON GLACIER ICE,	W71-08028 06B
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W71-08032 CARICIDES POPULATION DYNAMICS AND SALINITY TOLERANCE OF HYADESIA PUSCA	ADMINISTRATIVE DECISIONS PORT WARDENS V MARYLAND CAPITAL YACHT CLUB (ADMINISTRATIVE DETERMINATION OF IMPAIRMENT OF NAVIGATION IN RIVER). W71-07987 06E
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CCLIMATIZATION SPECTRUM OF BIOLOGICAL CONCERNS FROM POWER PLANT THERMAL DISCHARGES, W71-08302 05C	W71-08200 AN ACT RELATING TO THE DEPARTMENT OF AIR AND WATER POLLUTION CONTROL EMPOREMENT PROCEDURE FOR TEMPORARY AND NON-CONTINUING VIOLATIONS.
CCRETION (LEGAL ASPECTS) UNITED STATES V BOYNTON (BOUNDARY OF RIPARIAN LAND WHICH HAD BEEN MEANDERED). W11-07750 06E	W71-08259 ADMINISTRATIVE REGULATIONS WATER CLASSIFICATION STANDARDS SYSTEM FOR THE STATE OF SOUTH CAROLINA.
HUGHES V. WASHINGTON SOME PEDERAL COMMON LAW IN THE REAL PROPERTY AREA, W71-08255 06E	W71-07710 06E ADOPTION OF PRACTICES BUREAU OF LAND MANAGEMENT PROGRAM POLICYENVIRONMENTAL
CID MINE WATER PRECIPITATION AND RUNOPF,	CONSIDERATIONS. W71-08248 06E
W71-07936 05C GEOCHEMISTRY OF WATER, W71-07938 05C	ADSORPTION CARBON ADSORPTION FOR RECOVERY OF ORGANIC PESTICIDES, W71-07769 05a
STREAM BOTTOM PAUWA, W71-07940 05C	ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS, W71-07910
FISH POPULATION, W71-07941 05C	ADVECTION EVAPOTRANSPIRATION FROM AN IRRIGATED TURP UNDER ADVECTION OF DRY AIR AT DAVIS, CALIFORNIA,
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TREATHENT OF DISTILLERY WASTES-A CASE HISTORY, W71-08003	POPULATIONS SELECTED WITH VARIOUS SINGLE COMPOUNDS AND WITH MUNICIPAL WASTES AS SUBSTRATES, 971-07766 05D
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(STATE POWER TO REQUIRE CITY TO ABATE POLLUTION OF RIVER). H71-07741	N71-07960 02C
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CITY OF BIRMINGHAM V FLOWERS (DAMAGES RESULTING PROM
IMPROPER CULVERT).
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WATER-RESOURCES RECONNAISSANCE OF A PART OF THE HATANUSKASUSTINA BOROUGH, ALASKA,
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ALFALFA
SHADING INVERTED PYRANOMETERS AND MEASUREMENTS OF RADIATION REFLECTED FROM AN ALFALFA CROP,
W71-07812
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HIGH MOLECULAR WEIGHT ALGAL SUBSTANCES IN THE SEA,
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CONCENTRATION OF STRONTIUM-85 AND CESIUM-137 FROM WATER SOLUTIONS BY CLADOPHORA AND PITHOPHORA, W71-08032

ALGAL EXUDATES HIGH HOLDCULAR WEIGHT ALGAL SUBSTANCES IN THE SEA, W71-07878 02L

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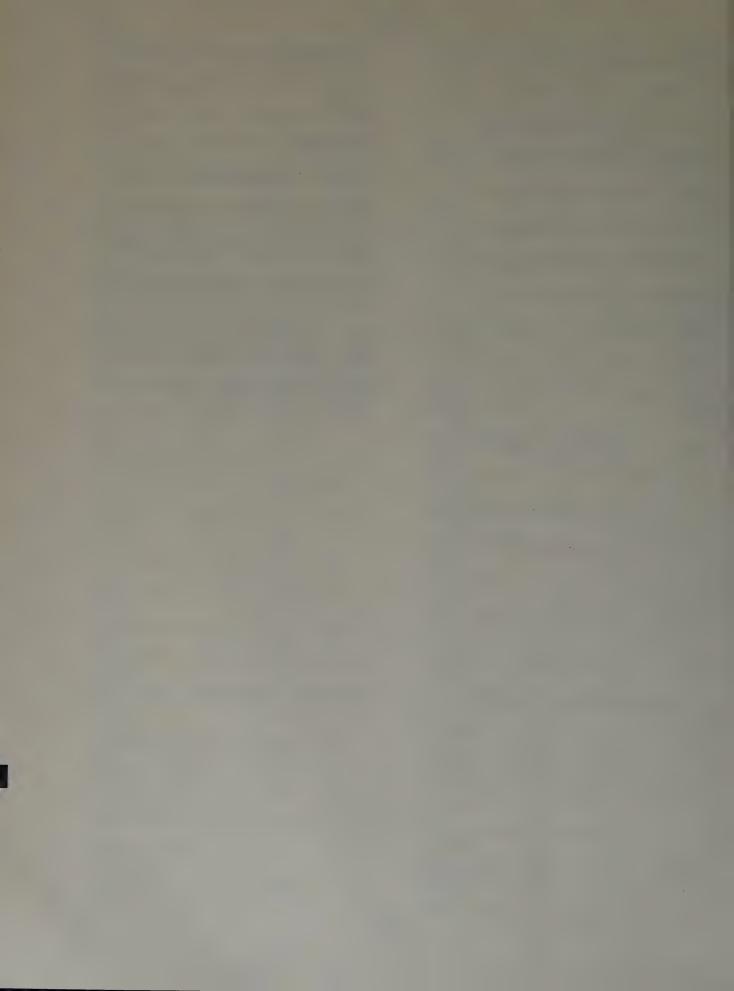
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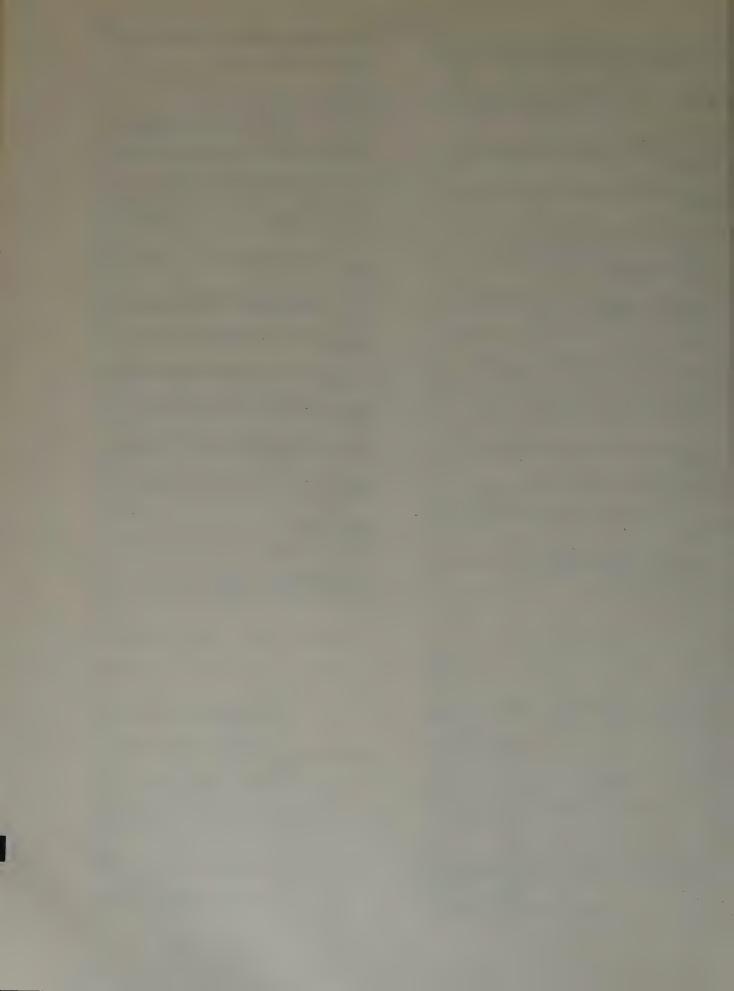
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Environmental Technical Applications Center	W71-07838	1
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA-Water Quality Office, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources
 of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Water Quality Office of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association Research Foundation.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
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